Proceedings of the
American Association of Textile Chemists and Colorists

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December 17, 1956

AATCC Calendar

COUNCIL
Jan 18 (Hotel Statler, New York); Mar 29 (Roanoke, Va); June 7 (New York)

NATIONAL CONVENTIONS
Nov 14-16, 1957 (Hotel Statler, Boston); 1958 (Hotel Conrad Hilton, Chicago); 1959 (Sheraton Park and Shoreham Hotels, Washington, D C); 1960 (Philadelphia, Pa); 1961 (Buffalo, NY)

MID-WEST SECTION
February 16 (Hotel Bismarck, Chicago, Ill)

NEW YORK SECTION
Jan 23, M 1 (Hotel Delmonico, New York, NY); Apr 26, May 24—ladies nite (Kohler's Swiss Chalet, Rochelle Park, NJ); June (Annual Outing)

NIAGARA FRONTIER SECTION
Jan 11, Mar 15 (Buffalo, NY); Apr 5 (joint meeting with CATCC at Kitchener, Ont)

HUDSON-MOHAWK SECTION
Jan 25 (Jack's Restaurant, Albany, NY); Mar 29 (Johnstown, NY); May 17 (Ladies Nite—Schuyler Meadows, Albany, NY); June 21 (Outing—Antlers Country Club, Amsterdam, NY)

PHILADELPHIA SECTION
Jan 11 (site to be announced)

PIEDMONT SECTION
Jan 26 (Poinsett Hotel, Greenville, SC); Mar 30 (Hotel Roanoke, Roanoke, Va); June 7-9 (Outing—Mayview Manor, Blowing Rock, NC); Sept 28 (Hotel Barringer, Charlotte, NC)

Employment Register

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.

56-15

Education: High school graduate; Rhode Island School of Design—2 years of chemistry.

Experience: 25 years superintendent-general manager—dyeing, printing and finishing.

Age: 55; married; references.

Position desired: Superintendent or manager, textile printing plant.

Location: New England preferred; will travel. 12-17, 12-31

TCR COMMITTEE ON NUCLEAR RADIATION INVITES PARTICIPATION

Kenneth H Barnard, chairman of the Committee on Nuclear Radiation, has invited those who are interested in any aspect of nuclear radiation, or are planning on setting up a radiation laboratory, or want to keep up with the progress in this activity, to submit to him their name, address and particular interest in this committee's future work. Mr Barnard's address is: Box 74, Barnstable, Mass.

At the November 16, 1956 meeting of AATCC's Technical Committee on Research, Mr Barnard reported as follows:

"This subject, which during the last war was so hush hush that few except those interested in military bombs knew anything about it, is now out in the open. Many government reports previously classified have now been released and the development of the 'Peaceful Atom' is being pushed. The average man is losing his fear that his health or virility will be endangered as these radiations present much the same degree of hazard as that in handling any other dangerous chemical, such as acids, caustic or chlorine. In fact those of us who have to have our teeth or lungs X-rayed are in about the same jeopardy as the average technician in a radio-isotope laboratory.

"With the rapid growth of nuclear power for submarines, cargo ships, the commercial production of electricity, etc, many of the scientific societies have active groups working on standardization, definitions, instruments and applications of these radiations. Such work is just beginning in textiles. Henry Rutherford is pioneering on the effect of radiation on different fibers using the new reactor at North Carolina State College. The Piedmont Section has an active research group under Alfred Clifford of Reigel Textile. TRI at Princeton has an analytical lab for using radio isotopes in tracer technique, but the potentials of nuclear radiation as an aid to textile technology are far from being fully utilized. In order to promote interest and knowledge of what is going on in this field, the TCR has set up this fact-finding committee to collect information, serve as a clearing house for it and make it more readily available to our membership."

Future Papers

The following material has been submitted to date to the publishers of American Dyestuff Reporter. Subject to the approval of the AATCC Publications Committee, it will appear in the Proceedings in future issues.

Authors, section officials, and committee chairmen are requested to inspect this list and notify the publishers if there are any omissions.

Papers presented at the Perkin Centennial under AATCC sponsorship:

"The Development of Fast Colors for Textiles"—F M Fordemwalt, American Cyanamid Co

"The Development of the Art of Textile Printing"—Herman P Baumann, American Aniline Products, Inc

"The Development of Modern Textile Dyeing Techniques"—P L Meunier, E I du Pont de Nemours & Co, Inc

"The Application of Colorants to Glass Fibers"—R F Caroselli, Owens-Corning Fiberglas Corp

"Internal Application of Colour in the Manufacture of Man-Made Fibers"—C E Coke, et al, Courtaulds, Ltd

"The Sulfur Dyes"—J L Crist and R E Rupp, Southern Dyestuff Corp

"Effects of Latex Compounds on the Dyeing of Spun Viscose Rayon Carpeting with Selected Fast to Light Direct Dyes"—South Central Section, AATCC

"Cationic Softeners—Their Secondary Effects on Textile Fabrics"—Philadelphia Section, AATCC

Papers presented before local sections:

"Far Infra-red for Textile Dyeing and Finishing"—W L Thomson, Edwin L Wiegand Co

"Lighting Factors to be Considered in Textile Color Matching"—Warren B Reese, Macbeth Daylighting Corp

"The Chemnyle Process for Dyeing Filament Nylon"—Walter H Hindle, The Chemstrand Corp

"Progress in the Art of Bleaching"—B K Easton and N Weinberg, Becco Chemical Division

"Binders for Nonwoven Fabrics"—Neil H Sherwood, B F Goodrich Research Center

"Technology of Nonwoven Fabrics"—L G Lovin and L P Wenzell, Celanese Corp of America

"Developments of Science and Industry in the South"—Frank J Soday, The Chemstrand Corp

"Wet Processing of Lurex"—Leon E Seidel, The Dobeckmun Co

"Random Tumble Pilling Tester"—A G Scroggie, E I du Pont de Nemours & Co, Inc

Miscellaneous:

"The Interaction of Cellulose with Simple Salt Solutions and with Dyebaths"—Mary Moncrieff-Yeates and Howard J White, Jr

"Leucoesters of Vat Dyestuffs"—Hans Luttringhaus, Progressive Color & Chemical Co

Other Perkin Centennial Papers:

"A Century of Progress in Colorfastness Test Methods"— M L Staples, Ontario Research Foundation

"The Standard Depths of Shade in Relation to the Assessment of Colorfastness of Dyes on Textiles"—Paul Rabe, Farbenfabriken Bayer AG

"Dyes and Dyeing Processes for Special Properties of Color"—J S Kirk, General Dyestuff Co

"Progress in Measuring Color Difference" — G W Ingle, Monsanto Chemical Co

"The Use of Color in National Defense"—S J Kennedy, Quartermaster Research and Development Command

"Seeing Light and Color"—Ralph M Evans, Eastman Kodak Co

"The Chemistry of Organic Pigments"—A Siegal and W S Struve, E I du Pont de Nemours & Co, Inc

"Color in Relation to the Political and Economic History of the Western World" — S M Edelstein, Dexter Chemical Corp

"Color in Ancient Times"—Earle R Caley, Ohio State Univ

"Color Designation through the Ages"—Ernest R Kaswell, Fabric Research Laboratories, Inc

"America's Debt to Perkin"—Samuel Lenher, E I du Pont de Nemours & Co, Inc

"Early Synthetic Dyes"—Hans Z Lecher, consultant

"Synthetic Dyes for Cotton"—D I Randall, General Aniline & Film Corp

"Dyes for Animal Fibers"—James Ogilvie, National Aniline Div

"Dyes for the Hydrophobic Fibers"—H E Schroeder and S N Boyd, E I du Pont de Nemours & Co, Inc

"Fluorescent White Dyes"—Robert S Long, American Cyanamid Co

"The Theory of Dyeing Cellulosic Fibers"—Emery I Valko, Onyx Oil & Chemical Co

"Theory of Dyeing Polyester and Polyacrylic Fibers"—W R Remington and H E Schroeder, E I du Pont de Nemours & Co, Inc

MEMBERSHIP APPLICATIONS FOR JANUARY ELECTION

November 30, 1956

SENIOR

Eugene E Anderson—Chemist, Nat Aniline Div, Allied Chem & Dye Corp, New York, NY. Sponsors: S V Vaniotis, K Hahn.

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Richard P Germann—Application res chemist, Davison Chem Co Div, W R Grace & Co, Baltimore, Md. Sponsors: G Hermann, A Darbey.

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Paul S Hess—Tech director, General Plastics Corp, Paterson, NJ. Sponsors: N C Shane, E B Whitworth.

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Roy L Ward—Text technologist, Home Economics Res Br-ARS-U S Dept of Agric, Agricultural Res Center, Beltsville, Md. Sponsors: R P Dawlen, V I McLendon.

JUNIOR

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Ernest L Wright—Res chemist, Dan River Mills, Inc, Danville, Va. Sponsors: H Y Jennings, H M Chase.

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Patsy R Pagliuco—Textile colorist, Verona Dyestuffs Co, Union, NJ.

APPLICATION FOR TRANSFER TO SENIOR MEMBERSHIP

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Austin C Woodside—Lowell Tech Inst. Sponsor: G R Griffin.

Gerald L Harrison — Philadelphia Textile Inst, Sponsor: W H Hughes.

John J Klocko—Philadelphia Textile Inst, W H Hughes.

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1956 Intersectional Contest———

THE APPLICATION OF ELECTRICAL INSTRUMENTS FOR MEASURING MOISTURE CONTENTS OF TEXTILES*

NEW YORK SECTION

INTRODUCTION

THE progress of man has developed a new concept of activity, AUTOMATION. On every side one sees evidence of the utilization of automatic controls or devices which lighten the burden of everyday toil. Our industry, the processing of textile materials, has not lagged in this respect. Today we accept as commonplace automatic pH control, automatic control of plant effluents, automatic flow control and automatic heat control. It is natural therefore to accept, in fact anticipate, automation along other lines. This paper concerns itself with an additional automatic control, namely the electrical measurements and control of moisture in textiles. It is our purpose to consider those applications which currently employ such control and to evaluate some of the more important variables which may influence the measurements. If we are successful in stimulating interest in this newer form of automation, then our purpose will have been accomplished.

"Of all the finishing aspects in making a piece of cloth marketable, drying perhaps contributes more to the manufacturing cost than any other single operation" (*1*).

Not only is the drying operation important economically, but the amount of residual moisture in the fiber will have an important bearing on the physical characteristics, such as elasticity, rigidity and swelling properties (*2*).

Since the drying of textiles is so doubly important, it has been the subject of many scientific investigations. The subject of moisture content at equilibrium conditions has been reviewed and discussed in a series of papers by Whitwell and his coworkers (*3, 4, 5, 6, 7*). Likewise, the determination of moisture in textiles has been the subject of many investigations. Historically, it was done by oven methods, whereby the material was dried to constant weight. Various direct and indirect methods have been employed to develop more rapid procedures, based upon the correlation between some rapidly measured property and the moisture content (*8, 9*).

In some, the humidity of air close to or drawn through the material is determined and related back to the moisture content of the textile (*10, 11*). In other cases, the various electrical properties of the textiles are measured. Varying moisture contents will affect the electrical resistance, the dielectric constant, the power factor and the capacitance of textile material (*12*). Likewise, the detecting and measuring devices have been tied into controlling mechanisms so that instruments can do more than indicate the moisture content; they can use this information to control drying speeds and/or temperatures (*13, 14, 15*). Such instruments and controllers have been applied successfully and reports have been made of their economic advantage (*16*).

In the critical examination and evaluation of different types of instruments, Toner, Whitwell and Bowen (*17, 18, 19, 20*) have studied instruments which depend upon measurement of DC resistance, of AC impedance and of dielectric constant. They found that the instruments when properly calibrated and employed were equal to or better than oven testing in precision of results. They also found that the fundamental calibration curves were shifted under influence of temperature, type of material, its history and the presence of impurities.

This paper is concerned with various types of meters under different application conditions in an attempt to determine the variables which will play a part in the success or failure of their operation.

It is the objective of this paper to point out the extent to which these electrical meters are in use and the degree of confidence which they are now receiving, to enumerate the factors which can affect the performance of several types of instruments, and to find which of these factors cause sufficient effect to require a separate calibration for the precision required within prescribed moisture tolerance.

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**Contributing nonmember of AATCC.

It is generally established that the instrumental measurement and control of moisture is an important factor in the textile industry. This was substantiated by citations from general practice together with direct testimonials from important mills. The instruments employed for measuring moisture are described in detail together with comparative results of oven-drying techniques. A considerable number of variables with despect to the fibers themselves, such as dyestuffs involved, scouring, etc, were covered in order to determine their influence with respect to a given instrument.

It is not the purpose of this paper to recommend or refute the use of any given instrument for the measurement of moisture but merely to present conclusions and limitations as derived from the Committee's own experimental work.

A rather extensive bibliography has been included in order to permit those interested in the subject to familiarize themselves with most of the work which has been done in the field.

It is the conclusion of the Committee that instrumental methods of moisture determination constitute a definite contribution to the textile industry and, when properly employed, such methods can be a real service to the processor of textiles.

*Presented by Edgar E Lineken on September 15, 1956 at the Waldorf-Astoria, New York, NY, during the Perkin Centennial.

Figure 1
Hart Moisture Meter
(Manufactured by Raymond S Hart, Inc, 336 West Islip Blvd, Babylon, NY)

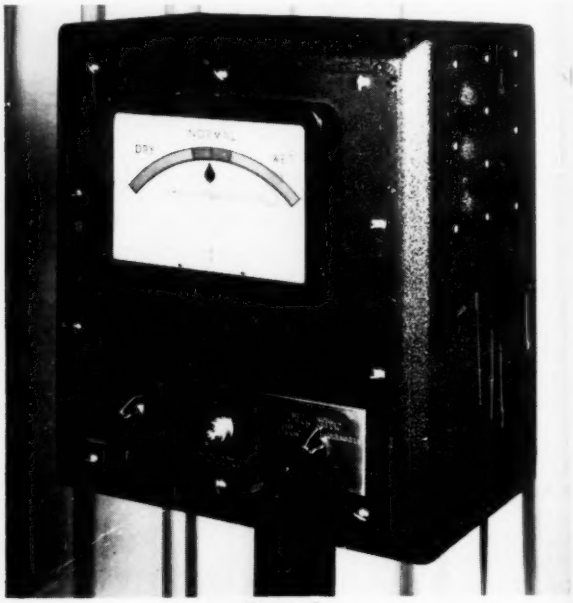

Figure 3
The Strandberg Moisture Monitor
(Manufactured by Strandberg Engineering Laboratories, Greensboro, NC)

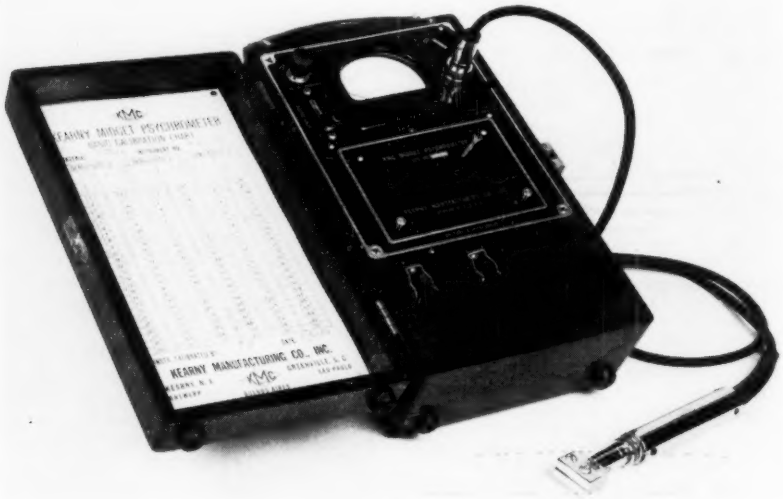

Figure 2
The KMC Midget Psychrometer
(Manufactured by Kearny Mfg Co, Inc, Kearny, NJ)

INSTRUMENTS

GENERAL PRINCIPLES——These meters depend for their operation upon changes in electrical properties with changes in moisture content and they must be calibrated against samples of known moisture content. This calibration is normally done by the manufacturer for specific uses. The measurements are made by bringing the textile material in question into contact with the instruments' electrodes in some reproducible fashion. The reading obtained is interpreted by way of the calibration chart or curve as moisture content. Moisture meters can be broadly classified into two types according to the electrical property changes being measured. One type interprets direct current resistance (or its reciprocal, conductance) changes as moisture content changes. There is said to be nearly a log log relationship between direct current resistance and moisture content for many materials, therefore moderate changes in sample thickness and even in sample composition have no important effect when resistance decrease is interpreted as moisture increase. The other type depends chiefly upon a correlation of the samples' electrical capacitance changes, or changes in dielectric properties, with moisture changes and this type requires alternating current.

It is not the purpose of this paper to describe the details of various instruments. Some of them are illustrated together with their electrode systems. Various types of electrodes, such as clamp type, surface type, or penetrating type, depending upon the form of the material to be measured, can usually be had for a given instrument.

RESISTANCE TYPES OF INSTRUMENTS——The performance of these instruments is based on direct current resistance changes of a piece of material brought in contact with electrodes in some reproducible fashion.

In Figure 1 is shown the Hart meter with clamp type of electrodes such as those used for the determination reported in this paper. The Midget Psychrometer is shown in Figure 2 with the bar (surface type) electrodes with which data reported in this paper were obtained. Figure 3 shows a cut of the Strandberg Moisture Monitor, which is frequent-

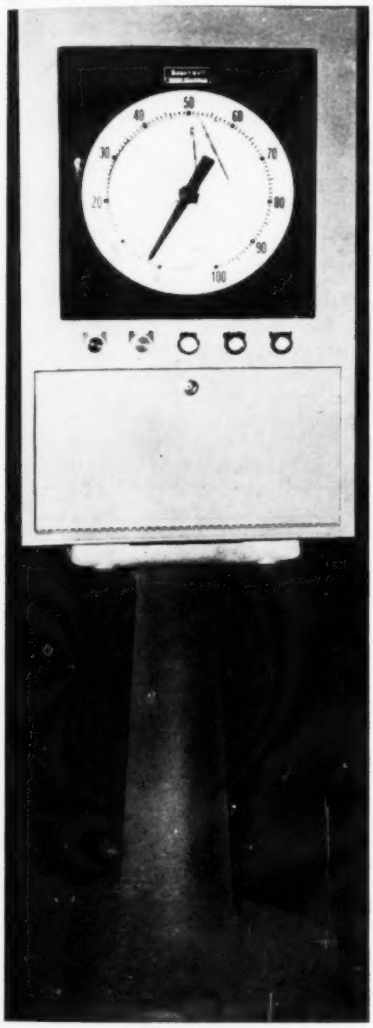

Figure 4
The Honeywell Moist-O-Graph (Pedestal Mount)
(Manufactured by Minneapolis-Honeywell Regulator Co, Wayne and Windrim Aves, Philadelphia 44, Pa)

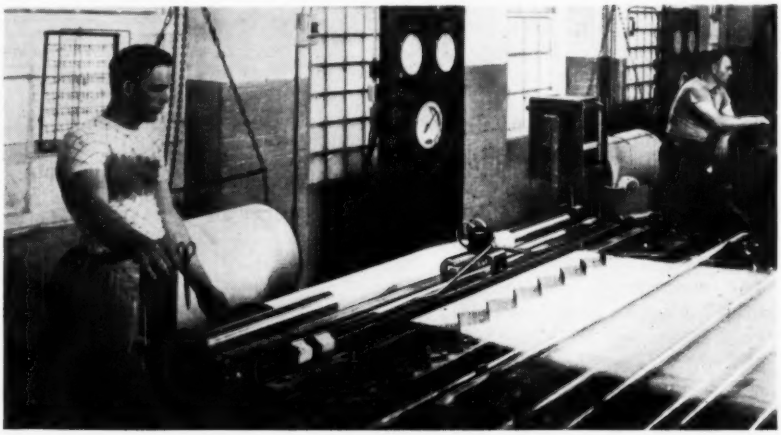

Figure 5
Electrode for Honeywell Moist-O-Graph installed for slasher control

Figure 6
The Moisture Register Model PD1
(Manufactured by Moisture Regulator Co, Alhambra, Calif)

ly used with recording and control devices. Figure 4 shows a Honeywell Moist-O-Graph pedestal mount and Figure 5 shows its roller electrode as installed for slasher control.

ALTERNATING CURRENT INSTRUMENTS——These instruments depend upon changes in dielectric properties of material corresponding with changes in moisture content. The material is caused to change the impedance of a circuit by placing it between the plates of a condenser or by placing concentric ring electrodes in contact with the material.

In Figure 6 is shown the Moisture Register with ring-type contact electrodes.

CURRENT PRACTICE

Oven methods are the classical ones for determining moisture in fabrics. These methods have several disadvantages: much time is consumed in drying duplicated samples to constant weight, the samples must be cut from the fabric (destructive sampling), moisture content changes during transfer, weighing, etc, and all loss while heating is intepreted as moisture loss whereas it might not be wholly moisture in all cases. The Braebender Drying Oven permits the weighing of the sample in the oven and is less time consuming than the classical oven methods. Electrical methods are rapid, they can be used to actuate recorders or controls, and they are highly precise. For example, "the instrument in which the sample to be tested is clamped between the electrodes is approximately twice as precise as ovens" (*20*).

Questions concerning actual practice in the use of meters were submitted to a number of firms, mostly AATCC members using such instruments. Of twenty-two who replied, eighteen indicated uses they had found for the meters. Instruments were used for checking the moisture content most frequently of cotton and wool, quite frequently of viscose, acetate and nylon, and occasionally of Dacron, jute and blends. Moisture controls are quite commonly used for maintaining proper moisture tolerances of warp yarns

emerging from slasher dryers. A variety of portable instruments in addition to permanently installed moisture meters are also in use.

Other sources of information indicate the following. Meters are used to determine moisture in fabric before embossing and before resin treatment. The Hart meter with "roller skate" type electrodes is operating in the 5 to 13% range with ±0.5% accuracy in one plant. Good correlation is obtained at one mill with Braebender Drying Oven values when checking the moisture content in scoured wool stock at the dryer in the 16 to 20% (±2%) range; also, wool top is spot-checked for moisture content in the 8-12% (±2%) range with the Moisture Register. At another mill the Hart meter is used in production problems on incoming wools (about 10% moisture), blended and oiled wools (20-25% moisture), card roving (12% moisture) and spun yarn (10-12% moisture). At one laboratory oven drying methods are preferred for accurate moisture determinations on finished wool top. The preference for ovens stems from the calibration care required, the number of tests required for samples containing an uneven moisture distribution and large effects should moisture happen to be concentrated at the top of the sample when electrical meters are used. The same laboratory uses a moisture meter to check the moisture content of scoured wool for the card room. The Honeywell Moist-O-Graph is frequently used to control slasher operation and its successful use in controlling the drying of fabrics will be discussed below.

The Strandberg Moisture Monitor is used to control slasher and tenter frame drives and it is used extensively to determine moisture content on textile slashers, tenter frames and pickers.

The moisture content of cotton and viscose fabric, dyed or undyed, is determined electrically before resin treatment.

The use of moisture meters for determining the moisture content after a resin-treated fabric has been dried and prior to mechanical finishing is very important. The moisture in the fabric during mechanical finishing determines to a large extent the gloss of the treated fabric and must also be controlled to prevent sticking of the fabric to the rolls of the mechanical finishing machine. Usually, the resin-treated fabric is dried to a point where 8 to 16% moisture is retained in it prior to its passage through the rolls of the mechanical finishing machine The moisture content may vary depending on whether the resin-treated fabric is glazed, Schreinered or embossed.

The international scope and continual developments in this field make it impossible to mention all of the most recent instruments or applications.

There is thus ample evidence that these instruments are sufficiently accurate in the uses for which they are calibrated and that they have found valuable places in checking moisture and in controlling dryer operation in many mills.

EXPERIMENTAL

The experimental study was designed to determine the magnitude of the effects of dyes, resins, salts, oils, etc, on electrically determined moisture values. The usefulness of comparisons of results with dyed and otherwise treated material with results with the base material is that the need for different instrument calibration curves or charts for such cases can be assessed in terms of the accuracy required. That meters are in use on wool, cotton, and viscose for moisture evaluation has already been shown.

WOOL (WORSTED YARN, DYED AND UNDYED)———In the marketing of worsted yarn the gross weight of the shipment is corrected for actual moisture content against normal regain of the wool content. This means that moisture content has a direct bearing on the market value of the product.

The use of oven-drying techniques has been discussed herein and the obvious need for less laborious methods is apparent.

This experiment dealt with a comparison of conventional oven-drying results with values determined with a resistance type of moisture meter, a Hart Moisture Meter which had been calibrated for undyed wool stock by the manufacturer. Fifty-two lots of natural or undyed worsted yarns were sampled and compared for moisture content by the two methods. Eighty-seven lots of variously dyed worsted yarns were considered separately.

The oven drying technique used in this study was the standard practice as outlined in ASTM Designation: D-1285-53T. Duplicate readings were taken on the moisture meter.

Figure 7 shows the comparison of the two methods of moisture determination on natural or undyed worsted yarns with the acceptable commercial limits surrounding the center line.

Figure 8 illustrates the scatter encountered in comparing dyed worsted yarns for moisture content by the conventional oven drying technique and through use of a moisture meter calibrated for undyed fiber.

These experiments indicate that fairly reliable results may be obtained with the resistance type of moisture meter on undyed or natural worsted yarns. The results obtained with a moisture meter of the resistance type, calibrated for undyed wool, on a variety of dyed worsted yarns taken at random show poor agreement with those obtained by conventional oven drying techniques. Using arbitrary limits of 1% on the results obtained by the two methods it can be shown that 92% of the results on natural yarns fall within this tolerance whereas only 65% of the dyed yarns fall within this tolerance. The average difference for the two methods on the 52 lots of undyed yarn was 0.29% with a standard deviation of 0.54%. For the dyed yarns the corresponding values on the 87 lots were: average difference 0.68%, standard deviation 0.85%. The meter tended to give distinctly low results for dyed yarn and slightly lower results for undyed yarn. The differences for undyed yarn seem not to be very significant.

EFFECT OF ADDITIVES TO WOOL STOCK———The side effects of additions to wool fiber on meter readings has been studied on BA Short Wool stock. A Moisture Register and an oven were used for determination of moisture content.

1) One type of wool, namely BA Shorts, was selected as the substrate for the sake of easiness of processing and uniformity of samples. Grease raw stock was picked twice and then given neutral and alkali scours as follows: Raw stock was scoured with nonionic detergent (Igepal CO-710) at 145°F, rinsed twice, extracted, dried in a hot air blower at 160°F for 1½ hours and picked twice. Grease content by ether extractions after scouring was 0.26%, and the pH of wool fiber was 6.8. Another portion of the raw stock was scoured with nonionic detergent (Igepal CO-630) and soda ash at 125-130°F, rinsed twice and processed as above. Grease content after scouring was 0.06%, and the pH of wool fiber was 9.7.

2) The samples in which moisture

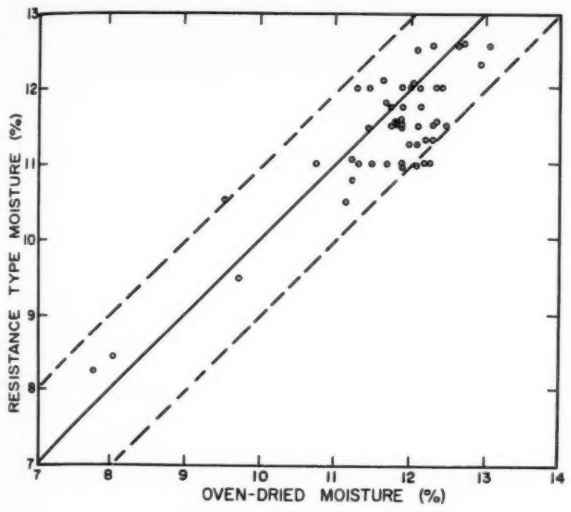

Figure 7
Resistance-type moisture meter vs oven-dried technique on natural worsted yarns

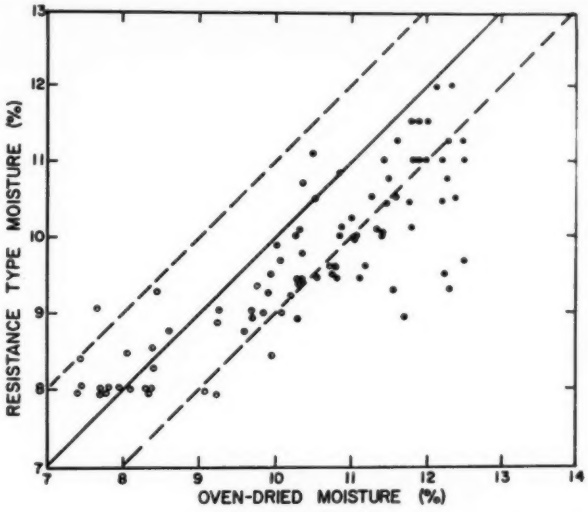

Figure 8
Resistance-type moisture meter vs oven-dried technique on dyed worsted yarns

was determined were prepared and moisture was determined as follows: Two-hundred-gram samples were weighed, treated with increasing amounts of various agents, extracted, dried in a blower at 160°F for 1½ hours, carded, and placed in cheese cloth bags to condition for 24 hours at 50% relative humidity. The weights of conditioned wool samples (see formula below) were determined. The samples were placed in a polyvinyl bag located in a 3-liter stainless steel pot and measured in six different places with the moisture meter. The average of six readings of the meter were converted into moisture content by the use of calibration curves specially prepared for this purpose (see below). The range of these six values is shown either in the tabulated data or on the curves in each case. The samples were placed in the oven and dried to constant weight (3-4 hours at 220°F). Thus, the moisture content by oven method was determined using the following formula:

$$\text{Percent moisture} = \frac{A-B}{A} \times 100$$

A—weight of conditioned wool
B—weight of bone dry wool

Along with the treated samples in each series of experiments one sample of untreated wool was conditioned and measured to serve as a control.

3) The meter was calibrated by the following procedure: Approximately 200 grams each of uncarded and also of carded neutral scoured wool stock and approximately 200 grams of alkali scoured and carded wool stock were placed in separate cheese cloth bags and then were successively

Dried for 20 minutes in the oven
Conditioned for 24 hours at 50% RH
Conditioned for 24 hours at 65% RH
Conditioned for 24 hours at 80% RH
Bone dried in the oven.

After each successive conditioning the samples were weighed (A, conditioned weight), measured by the meter at 70°F at six different places and the readings were recorded. After the last conditioning (at 80% rh), the samples were dried to constant weight (B, bone dry weight) and the moisture content was calculated by the use of the above formula for each condition of the wool. The bone dry samples, after being weighed, were put into airtight polyvinyl bags and cooled to 70°F, and then measured with the meter. Thus, three calibration curves were obtained by plotting average moisture register readings for each condition against moisture content determined by the oven method. Data are shown in Table I and Figure 9.

TABLE I
Meter scale readings vs oven moisture (70°F)

Condition of wool	Moisture Meter: Avg reading	Moisture Meter: Range	Percent moisture by oven
Uncarded Neutral Scoured Wool			
Bone dry wool	3.21	0.75	0
Conditioned at 50% rh	10.17	2	9.86
Conditioned at 65% rh	14.21	3	11.83
Conditioned at 70% rh	16.87	2.5	13.46
Conditioned at 80% rh	25.08	5.0	16.09
Carded Neutral Scoured Wool			
Bone dry wool	3.21	0.75	0
Dried 20 min in Emmerson oven at 220° F	5.67	2.00	6.27
Conditioned at 50% rh	9.29	1.75	10.44
Conditioned at 65% rh	13.50	1.00	13.12
Conditioned at 80% rh	24.47	6.00	16.92
Alkali Scoured, Carded Wool			
Bone dry wool	3.04	0.75	0
Dried 20 min in Emmerson oven at 220° F	4.92	1.00	6.09
Conditioned at 50% rh	9.04	2.00	10.50
Conditioned at 65% rh	14.71	3.00	13.21
Conditioned at 80% rh	28.19	9.50	16.92

One of the main purposes of this investigation was to determine whether various treatments of wool affect the determination of moisture content by an electrical moisture meter. That is why calibration curves were prepared only for our *untreated substrates* (neutral-scoured and alkali-scoured wool) and used for conversion of Moisture Register readings to moisture content taken on the *treated samples*. In this manner we were able to determine what effect different treatments have on the determination of moisture with the meter.

4) To determine the effect of residual salts left on wool after scouring, neutral-scoured wool as well as alkali-scoured wool were extracted in distilled water several times, and then prepared as described above. Results shown in Table II.

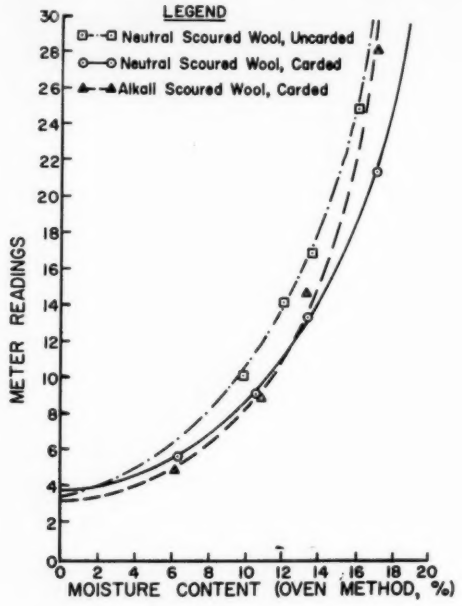

Figure 9
Calibration curves for moisture register—PDIC 207 at 70°F

TABLE II
Effect of salts left on wool following scouring

	Percent moisture by meter	Percent moisture by oven	Δ(meter-oven)%
Neutral scoured wool as is	10.7 ±0.5	10.07	+0.63
Neutral scoured wool extracted in distilled water	10.6 ±0.4	10.1	+0.50
Alkali scoured wool as is	10.5 ±0.4	10.06	+0.44
Alkali scoured wool extracted in distilled water	10.75±0.4	10.29	+0.46

TABLE III
Effect of dung and burrs on meter readings

	Percent moisture by meter	Percent moisture by oven	Δ(meter-oven)%
Clean wool	10.1 ±0.4	8.63	+1.38
Wool contamination with dung and burrs	10.0 ±0.4	8.73	+1.27

The residual salts, if any, left on wool after scouring did not affect the measurement to any significant degree. Moisture content as measured by the meter was higher than moisture content determined by oven method by approximately one-half of one percent, which lies well within the limits of the experimental error of the instrument.

5) The degree of contamination of wool with dung and burrs generally varies appreciably and it was thought that their effect should be studied. For this purpose, neutral-scoured wool was carded three times, then one part was extracted with trichlorethylene and the other part was purposely contaminated with dung and burrs. Both samples were boiled for one hour with 4% sulfuric acid owf to exhaust the dung on the wool and then processed as described above for testing. Table III shows the effects.

The contamination of wool with dung and burrs does not interfere with the moisture determination by the meter. Moisture Register reads, however, higher moisture (see Table III) possibly because of the felting and swelling of the carded wool during boiling.

6) It was noticed during our experiments that there was a difference in readings depending upon whether wool was carded or not as shown in Table IV.

Calibration curves for *carded* wools were used for both carded and uncarded samples. Uncarded wool shows *appreciably higher* moisture content by meter than carded. This fact should not be overlooked in practice.

TABLE IV
Effect of physical state of wool on meter values

	Percent moisture by meter	Percent moisture by oven	Δ(meter-oven)%
Neutral-scoured wool, not carded	12.75 ±0.4	9.95	+2.8
Neutral-scoured wool, carded	10.75 ±0.2	10.38	+0.37
Alkali-scoured wool, not carded	12.70 ±0.4	10.08	+2.62
Alkali-scoured wool, carded	11.40 ±0.7	10.41	+0.99

7) To find the effect of common salt on meter values, six samples were boiled for half an hour with increasing amounts of common salt at a liquor ratio 20:1. These samples were not rinsed after boiling but just extracted, dried and they were not carded in order to leave the salt on the fiber. The calibration curve for uncarded, neutral-scoured wool was used for conversions (Figure 9). The effects found for salt are shown in Figure 10.

The presence of common salt on the wool fiber has a definite effect on meter measurements. The Moisture Register may show up to 2.45% higher moisture content above the actual moisture present, the average of all differences being 2.11%. A special calibration curve should be prepared for wool containing salt if high accuracy is required. The measured moisture content both by meter and oven has a tendency to get higher as the concentration of salt on the fiber increases.

8) To determine the effect of a mineral acid, alkali-scoured wool was boiled for one hour with increasing concentration of sulfuric acid, then rinsed, processed, and measured with the results shown in Figure 11.

The Moisture Register reads somewhat higher moisture content than oven (+0.84% average). The higher meter values are not caused by the sulfuric acid treatment but by boiling the wool since the higher values appear for the sample boiled without acid. The concentration of the acid on the fiber does not seem to have any general effect on the moisture measurements. A calibration for "boiled" wool would be required for highest accuracy.

9) To determine the effect of an organic acid, alkali-scoured wool was boiled with increasing concentrations of hydroxyacetic acid, then rinsed, processed, conditioned at 50% rh, and measured for moisture content with the results shown in Figure 12.

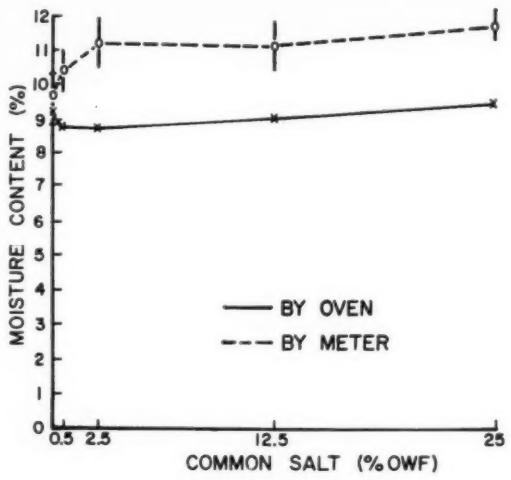

Figure 10
Effect of common salt on electrically measured moisture values at 70°F and 50% rh

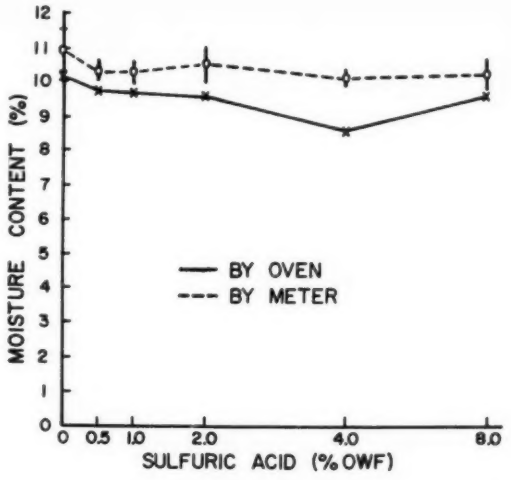

Figure 11
Effect of sulfuric acid on electrically measured moisture values at 70°F and 50% rh

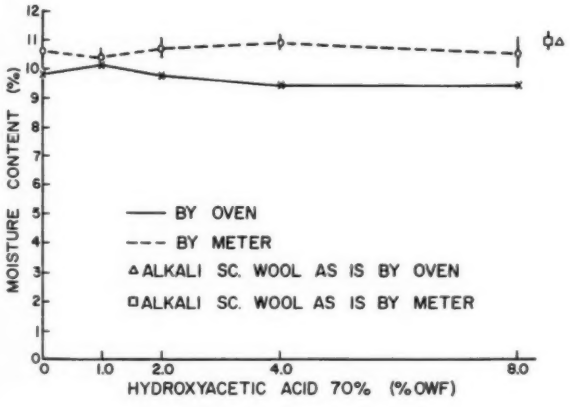

Figure 12
Effect of hydroxyacetic acid on electrically measured moisture values at 70°F and 50% rh

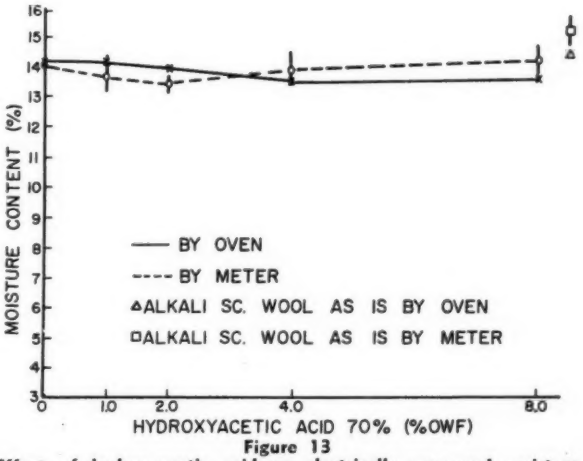

Figure 13
Effect of hydroxyacetic acid on electrically measured moisture values at 70°F and 70% rh

The meter showed consistently higher moisture content (average +0.92%) and it may show up to 1.45% higher moisture content than the oven. The results obtained with hydroxyacetic acid are similar to those obtained with sulfuric acid.

In order to see what results may be expected at higher moisture contents, we conditioned the same samples (before bone drying) for an additional 24 hours at 70% rh. The results of this experiment are shown in Figure 13.

In this case, treated wool and that conditioned at 70% rh shows lesser differences in moisture content between oven and meter than one conditioned at 50% rh. The highest difference is only +0.63% or −0.5%. Amazingly enough, this was the only instance when the moisture meter showed lower moisture content than oven. The reason for these results is not understood. It seems, however, that at higher moisture contents the meter values proved to be less affected by the boiling treatment.

10) Alkali-scoured wool was dyed with increasing percentages of an acid dye, *CI* 1054, using the following formula:

0 to 3% *CI* 1054
4% sulfuric acid conc
20% common salt
20:1 liquor ratio. Boiled 1 hour
(pH of liquor after boiling 1.70 to 1.95)

The dyed wool was rinsed, extracted, dried, carded, etc. The results are shown in Figure 14.

The meter reads consistently higher moisture content as compared to oven, approximately 2% higher, and therefore it should be calibrated for acid-dyed wool. The acid dye seems to have no effect on electrical determination of moisture. Meter values are also higher when no dye is present; therefore, the effect is due to the dyeing process and not to the dye concentration.

11) Alkali-scoured wool was dyed with increasing percentages of Irgalan Yellow GL using the following formula:

0 to 3% Irgalan Yellow GL owf
5% ammonium sulfate owf
0.5% acetic acid (56%) owf added at 150° F and another 0.5% acetic acid added at the boil.
Boiled 1 hour. Liquor ratio 20:1.

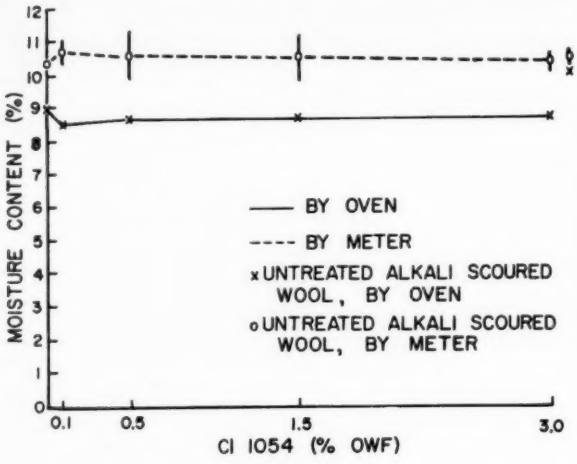
MOISTURE CONTENT (%)
BY OVEN
BY METER
x UNTREATED ALKALI SCOURED WOOL, BY OVEN
o UNTREATED ALKALI SCOURED WOOL, BY METER
CI 1054 (% OWF)

Figure 14
Effect of acid dye on electrically measured moisture values at 70°F and 50% rh

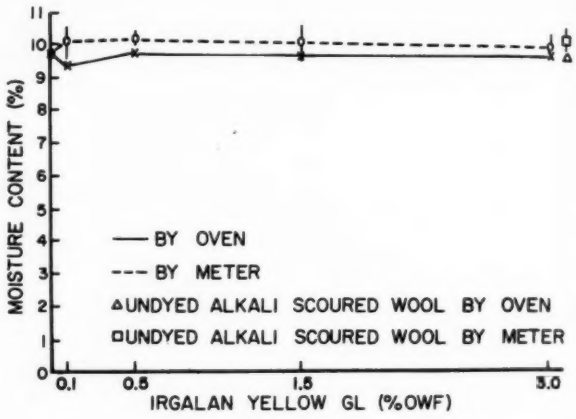
MOISTURE CONTENT (%)
BY OVEN
BY METER
△ UNDYED ALKALI SCOURED WOOL BY OVEN
□ UNDYED ALKALI SCOURED WOOL BY METER
IRGALAN YELLOW GL (%OWF)

Figure 15
Effect of neutral dyeing metallized dye on electrically measured moisture values at 70°F and 50% rh

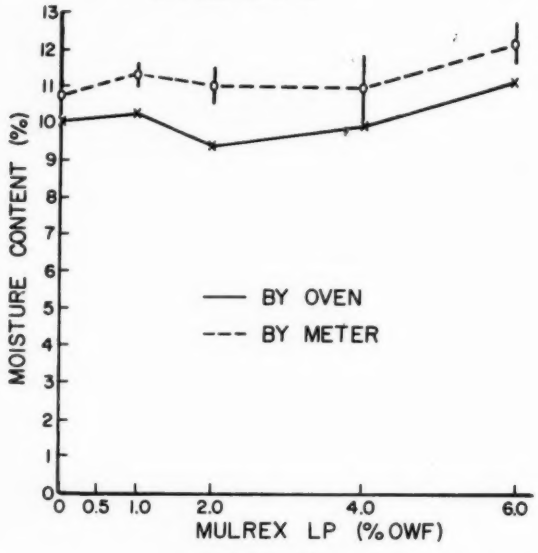

Figure 16
Effect of mineral spinning oil on electrically measured moisture values

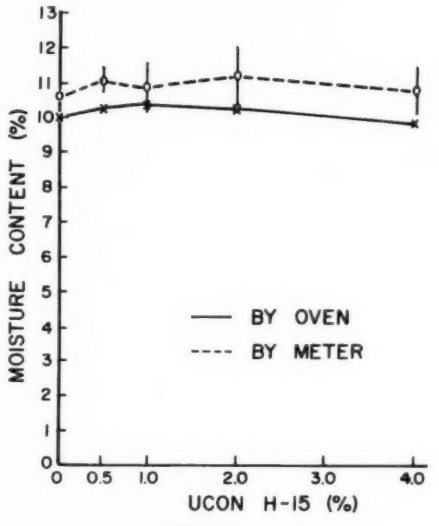

Figure 17
Effect of glycolic type spinning lubricant on electrically measured moisture values

Figure 15 shows a comparison of oven and meter values.

The meter reads on the average of +0.4% higher moisture content compared with the oven method, which is well within the usual tolerances. A special calibration for wool dyed with neutral-dyeing metallized dye would not be required.

12) The effect of a mineral type of spinning oil was determined as follows: Neutral-scoured wool was sprayed with Mulrex LP spinning oil emulsions in such a manner as to assure its containing increasing amounts of the oil. Sprayed samples were dried and carded. Results are shown in Figure 16.

The meter reads a uniformly higher moisture content over oven values (average +1.08%). The increase of oil from 2% to 6% owf caused distinct increase in moisture content both by meter and oven (hygroscopic oil).

It should be pointed out that the untreated sample here showed 0.68% higher moisture content by meter than by oven, which means that this oil does not affect electrical moisture measurements to any significant degree.

13) Neutral-scoured wool was sprayed with Ucon H-15, a polyalkyleneglycolic type of fiber lubricant, to assure its containing increasing amounts of this lubricant and processed as above with the results shown in Figure 17.

The presence of Ucon H-15 on the wool does not have any significant effect on electrical moisture determination. Moisture Register reads uniformly higher moisture contents (average +0.8%) over oven but it is within the limits of the experimental error. Untreated wool showed +0.68% higher moisture content by meter and we may therefore conclude that the polyalkyleneglycolic lubricant used does not affect meter measurements to any significant degree which would require a special calibration.

COTTON AND VISCOSE FABRICS——Bleaching, mercerizing and scouring involve only minor changes in the substrate and these effects are considered negligible as far as moisture content is concerned. Any electrolyte (and many dyes are electrolytes) will effect meter reading changes, but whether or not seriously so will depend upon the tolerances required, the electrolyte concentration (*17, 18, 19, 20*) and presumably also upon the electrical factor being measured.

The effects of dyes on results with several meters (Hart, Midget Psychrometer, Moisture Register) have been determined for the purpose of anticipating mechanical finishing operations or for marketing a standard product. The effects of resins and printing are also shown.

Results as determined on these cotton and viscose fabrics are reported as instrument scale readings at moisture regains based on moisture determinations by an oven method. This method of presentation has value because in effect it gives meter calibration data for base fabrics and for treated fabrics. Scale readings on the treated samples can be compared often enough with readings on the base fabric to show their relationships and thus to estimate the error introduced should base fabric calibration data be applied to treated fabric.

The textile treatments included in this study consist in general of the following:

1) Dyeings were made with 2 to 20% of sulfur, 1% of direct, 1.5 to 6 ounces per gallon of vat and 2% of naphthol (coupled with various naphthol fast salts) dyes.

2) Treatments with urea- and melamine-formaldehyde types of resins.

3) Printing and subsequent treatment of prints with about 6% of urea-formaldehyde type resin. The dyeings and resin treatments were applied to a bleached partially mercerized cotton cloth and to a spun viscose rayon cloth by standard procedures. The prints were applied to a bleached cotton cloth.

Three commercial moisture meters were used in this study. These are the Hart Moisture Meter Type K-101, the KMC Midget Psychrometer, and the Moisture Register Model PD1. All the meter measurements were made using a single thickness of test fabric. When the Moisture Register was used the test specimen during measurement was supported on a two-inch thick slab of polyethylene which was found to have negligible effect on the measured reading. Meter measurements were made on the test fabrics brought successively to moisture equilibrium at 65, 75 and 85% relative humidity and at a temperature of 85°F. Specimens were also taken at these conditions for moisture regain determinations by the oven method in accordance with ASTM Designation D629-55T.

To simplify the presentation of the test data which follow, the meter readings have been estimated for integral values of moisture regain from graphs of the meter readings plotted against moisture regain. For the purpose of plotting, the Hart readings were converted to numerical values by the method of Toner, Bowen, and Whitewell (*17*). Converted Hart readings are given in the tables. Kearny meter values were converted to electrical resistance by calibration of the instrument against standard resistors. The Kearny values given in the following tables have been reconverted to scale readings. The superscripts shown with the Kearny values represent the meter sensitivity scale used for the particular reading.

Five meter readings were made and averaged for each test sample. The values given in the following tables for the dyed and resin-treated fabrics represent average values obtained on three or four different samples each with different dyes or resins of the same general class. Members of each general class gave similar values.

The effect of dyeing and resin treatments on meter readings obtained with both cotton and rayon at several moisture regains is presented in Tables V, VI and VII. In general, at a particular moisture content, the treatments appreciably alter meter readings as compared with the untreated fabrics. The dye treatments have the effect of giving higher readings on the three meters. The resin treatments on the other hand result in lower meter readings. The final processing step in preparing each of these dyed and resin-treated samples was a thorough water rinse to remove soluble substances.

TABLE V

A comparison of readings on the Hart Moisture Meter with moisture regain values

Fabric	% Moisture regain (oven)	Meter readings* Undyed base fabric	Fabric dyed with: sulfur dyes	direct dyes	vat dyes	naphthol dyes	Undyed resin-treated fabric
Bleached cotton							
	6	5.0					4.5
	7	6.2			9.0	8.5	4.9
	8	7.5	9.6	>10	>10	>10	5.8
	9	8.8	>10	>10	>10	>10	
	10	10.0	>10	>10	>10	>10	
Spun rayon							
	11	6.4					5.5
	13	8.0				9.0	6.6
	14	8.8	9.8	10	9.4	—	7.2
	15	10.0	>10	>10	>10	>10	7.8
	16	>10	>10	>10	>10	>10	8.3

*Converted to numerical values (*17*).

TABLE VI

A comparison of readings on the Midget Psychrometer with moisture regain values

Fabric	% Moisture regain (oven)	Scale readings* Undyed base fabric	Fabric dyed with: sulfur dyes	direct dyes	vat dyes	naphthol dyes	Undyed resin-treated fabric
Bleached cotton							
	6	1.5^{1}					0.5^{1}
	7	5.5^{1}			3.0^{2}	2.5^{2}	3.0^{1}
	8	27.5^{1}	4.5^{2}	6.5^{3}	5.0^{3}		19.5^{1}
	9	40.5^{1}	11.5^{3}	14^{3}		10.5^{2}	
	10	46^{1}	31.5^{2}	27.5^{3}	49^{2}	25^{2}	
Spun rayon							
	13	1.5^{2}				4.0^{2}	26.5^{1}
	14	3.5^{2}	4.5^{2}	5.5^{2}	5.0^{2}		0.5^{2}
	15	5.5^{2}	6.5^{2}		10.5^{2}	12.0^{2}	
	16	10.5^{2}		17.0^{3}			3.5^{2}
	18	26^{2}	38.5^{2}	0.5^{3}	1.5^{3}	1.0^{3}	

*Scale readings at the sensitivities indicated by the superscripts.

TABLE VII

A comparison of readings on the Moisture Register with moisture regain values

Fabric	% Moisture regain (oven)	Scale readings: Undyed base fabric	Fabric dyed with: sulfur dyes	direct dyes	vat dyes	naphthol dyes	Undyed resin-treated fabric
Bleached cotton							
	6	16.0					8.8
	7	19.6			32.6	31.6	10.4
	8	23.4	39.4	44.8	40.6	39.6	11.8
	9	27.0	47.6	49.0	49.0	47.6	
	10	30.8	>50	>50	>50	>50	
Spun rayon							
	13	22.0				25.0	17.6
	14	23.4	24.6	27.4	27.4		19.0
	15	25.4	28.2		31.6	33.6	
	16	28.2		35.0			21.6
	18	33.8	38.8	43.0	44.8	46.6	

Table VIII shows the effect on meter readings of printing and subsequent resin treatments on a cotton fabric at several moisture regains. At any particular moisture regain the printing results in an appreciable increase in meter readings which is further increased (often beyond the scale of the meter) by the application of the urea-formaldehyde type of resin. It is interesting that the increase noted here with urea- formaldehyde treatment is opposite to the effect previously noted with similar resins. These higher values are undoubtedly due to electrolytes because the cured resin-treated prints had not been washed.

Differences in meter readings obtained on samples of cotton and rayon fabric at a moisture regain of 10% are presented in Table IX. Some of the differences shown may result from variation in fabric construction but it is apparent that the meter readings obtained with the viscose rayon fabric are appreciably lower than those obtained with the bleached cotton fabrics. Mercerization of the cotton also appears to have the effect of lowering the meter readings.

In summary, it has been shown by these tests on cotton and rayon that chemical treatments of the cellulose fiber in various textile operations has an appreciable effect on readings with moisture meters of both the resistance and capacitance types. A discussion of the underlying causes of these effects is beyond the scope of this paper, which is concerned primarily with the magnitude of these effects on meter readings. It may suffice to say, however, that the factors involved include changes in the electrolyte content or blocking of the hydroxyl groups of the cellulose molecule.

It is apparent from the results that for highest accuracy meters must be calibrated not only for the type of fiber or weave but also for each type of finish and dyestuff. Errors up to several percent may result if a finished fabric is measured and its moisture regain estimated from a calibration chart prepared for the unfinished cloth. Dyeings with various classes of dyes produced approximately the same effect. Observations of Tables V, VI, and VII show that the variations found were usually less than three percent moisture regain and were frequently less than two percent. (The exact assignment of variations for the Kearny meter on cotton for dyed samples requires values on the base fabric at higher regains.) As a rule, corrections are less for treated rayon than for treated cotton. It should be noted that dyes were applied in medium heavy strengths and that the effects would be expected to be less for lighter shades. No work was done to determine whether variations caused by dyestuffs were actually due to the dye or to ions which may have been retained by the fibers. The effects reported are those caused by the complete dyeing (or finishing) operation.

TABLE VIII

Effects of printing and resin treating

Meter	% Moisture regain (oven)	Scale readings: Bleached white cotton-base cloth	Printed only	Printed and treated with 6% urea-formaldehyde resin: uncured	cured
Hart	6	7.0			8.8
Kearny	6	0[1]			4.5[2]
Moisture Register	6	12.8	45.0		38.0
Hart	7	8.0	9.7	>10	>10
Kearny	7	4.5[1]	8[2]	12[2]	16.5[2]
Moisture Register	7	16.4	46.2	44.4	48.0
Hart	8	9.7	>10	>10	>10
Kearny	8	44[1]	12.5[2]	48[2]	0.5[3]
Moisture Register	8	20.8	47.6	>50	>50
Hart	9	>10	>10	>10	>10
Kearny	9	48[1]	14[2]	3[3]	5[3]
Moisture Register	9	27.6	>50	>50	>50
Hart	10	>10	>10	>10	>10
Kearny	10	14[2]			
Moisture Register	10	34.2	>50	>50	>50

TABLE IX

Comparison of base fabrics at constant moisture regain

	Scale reading at 10% moisture regain: Hart	Kearny	Moisture Register
Undyed cotton			
Bleached	>10	14[2]	34.2
Bleached partially mercerized	10.0	46[1]	30.8
Undyed rayon			
Undyed spun viscose	5.6	0.5[1]	18.4

PRACTICAL MILL EXPERIENCE

A number of companies have sent us summarizing statements and data showing practical uses which they are making of electrical effects of moisture. Those which are most detailed are cited below.

A) At one mill the Minneapolis-Honeywell Moist - O - Graph moisture recorder was very carefully studied when installed at the delivery end of a tenter dryer (*21*).

Conclusions as to the operation of the instrument were as follows: "The Moist-O-Graph showed good moisture content reproducibility on all fabrics, both white and dyed, except vat black; the Moist-O-Graph showed little error due to a change in weight through a ratio of 2 to 1; the Moist-O-Graph is not sensitive to tension or temperature variations, within the range of 2% to 14% moisture content; the Moist-O-Graph will not satisfactorily measure moisture contents less than 2% in cotton fabrics; we obtained interference from electrostatic charges at less than 1½% moisture at 200 yards per minute and 150 to 170°F fabric temperatures." When goods were being dried as the final process to not over normal regain (2% to 4% moisture), an accuracy of ±1% was sufficient. When goods were being dried preparatory to another process to 3%

to 10% moisture content, reproducibility well within ±0.2% on any given fabric and within ±1.1% over a number of fabrics within a two-to-one weight ratio was achieved.

The Minneapolis-Honeywell Moist-O-Graph moisture control system for slashing of warp yarns has been reported to be very satisfactory and to give adequate control for production purposes at another mill (22).

Moisture regain is controlled with only an occasional laboratory analysis for the cotton system since nearly all cotton size formulas are based on starch. The materials used for synthetic yarn sizing vary so widely in resistivity that calibrations and laboratory checks are required for each case.

B) At one plant the Hart "roller skate" type and the Fielden "plate" type instruments are in use (23).

They are used to control moisture in fabric before embossing and before resin curing. The Hart meter is used as a portable instrument and the Fielden meter is set at the drying frame. The meters are very useful plant tools. The Hart meter is said to be accurate to ±½% and the Fielden to ±2% in the 5% to 13% range. The Fielden instrument requires recalibration for different fabric constructions.

C) One company reports that the Moisture Register is very useful for getting on-the-spot readings on scoured wool and wool top that show good correlation with Braebender drying oven readings (24). The scoured stock is at 16% to 20% moisture content and the top is between 8 and 12%. Tolerances are in both cases ±2%. At one company a Moisture Register has been in use for seven years by the Inspection Department for moisture in soft fiber (jute, hemp, etc) where an accuracy of ± 1.5% is satisfactory (25).

SUMMARY

In the foregoing presentation we have endeavored to show the utility to the textile industry of electrical methods for moisture determination and control by bringing together the experiences of many commercial organizations with the results of our own testing procedures. It is known from the published work of others that electrical moisture meters are accurate when used on the material for which they are calibrated and it is also known that additives to textiles affect the readings of the meters. Our discussion shows to what degree the need for separate calibration due to substances (dyes, resins, etc) added to a base material (stock, yarn, fabric) depends upon the tolerances required. For example, it is unusual for effects larger than three percent moisture to be introduced and quite often the effect is one percent or less.

Specifically, the following conclusions are made:

1) Moisture meters are in rather extensive use industrially especially where rapid analyses are important.
2) Control systems actuated by electrical effects produced by moisture variation are quite commonly found, particularly for controlling the drying of yarns in slashers for cellulosics where the sizing materials are based on starch.
3) Rather heavy applications of several classes of dyes and resins to cotton fabric by standard methods produce variations usually equivalent to less than three percent moisture and frequently less than two percent as determined with three different moisture meters. The variations produced on spun viscose were in general less than on cotton.
4) Differences between oven and resistance type meter values on undyed worsted yarns were infrequently greater than one percent and no difference as large as one and one-half percent was found. Dyeing produced differences which were frequently more than one percent and occasionally more than two percent.
5) Effects on the readings of a capacity type of meter with wool stock were as follows: Those treatments affecting instrument values by not more than 0.5% moisture were dyeing with a neutral metallized dye, applications of a mineral spinning oil and of a glycolic type lubricant, and boiling with mineral and organic acids although the boiling operation itself probably changes the instrument value significantly. Those treatments having larger effects, 2% moisture and more, were the carding of the wool, the presence of common salt, and the acid dyeing procedure.

ACKNOWLEDGMENTS

The help of the following organizations for contributing to the content of this paper by supplying information, instruments, materials and/or experimental results is acknowledged: American Aniline Products, Inc; American Cyanamid Co; Bachmann Uxbridge Worsted Corp; Bates Manufacturing Co; Brewster Finishing Co; Cannon Mills; Celanese Corp of America; Chatham Manufacturing Co; Chicopee Manufacturing Corp; Columbian Rope Co; Dyersburg Cotton Products, Inc; Duofold, Inc; Erie Ave Mill Co; Erwin Mills, Inc, Excelsior Mills; Fieldcrest Mills, Inc; Firestone Textiles; The Foxboro Co; General Aniline and Film Corp; Hart Moisture Meters, Inc; Hathaway Manufacturing Co; Kearny Manufacturing Co; Klopman Mills Corp; Magee Carpet Co; Marriner Wool Laboratory; Minneapolis-Honeywell Regulator Co; Mohasco Industries, Inc; National Cotton Council of America; Olson Rug Co; Pepperell Manufacturing Co; Russell Manufacturing Co; The Springs Cotton Mills; J P Stevens & Sons Co; Strandberg Engineering Laboratories, Inc; United Merchants Laboratories, Inc; Ware Knitters, Inc; Western Electric Co; Wiscassett Mills Co.

The committee members wish to thank their associates for all aid which has been made freely available to them. The chairman especially thanks those members of the committee who have spent long hours in organizing this report and in doing the experimental and other work necessary for its completion.

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(21) The Springs Cotton Mills, Grace Bleachery, Lancaster, SC.
(22) Bates Manufacturing Company, Lewiston, Me.
(23) United Merchants Laboratories, Inc, 601 West 26th Street, New York 1, NY.
(24) J P Stevens & Co, Inc, Osgood, Mass.
(25) Columbian Rope Co, Auburn, NY.

AATCC Research———

PROGRESS REPORT OF THE STANDARD SOILS COMMITTEE

COMMITTEE

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*Former chairman

This progress report covers the development of a standard washing procedure needed to investigate the utility of artificially soiled fabrics. A standard procedure for measuring the reflectance of fabric is also developed. A method for presenting data is specified. The data obtained required statistical treatment to establish the limits of reliability. The 95% confidence limits obtained with a soiled cotton fabric from Testfabrics, Inc are ± 9% with 20 replicates and ± 12.5% with 10 replicates within laboratories. The agreement between cooperating laboratories is ± 12.5% with 20 replicates. Wash test data for the same soil on staple-fiber fabrics of rayon, acetate, silk, nylon, Orlon, Dacron, Dynel, and Acrilan are given. The confidence limits with these fibers were not as firmly established as cotton. No other type of soil was available to the Committee at the time the work was carried out.

The Committee sees no possibility of developing a single standard soiled fabric to include all end uses of detergents. The development of specific standard soiled fabrics is within the realm of possibility.

INTRODUCTION

THE Standard Soils Committee was originated to investigate the possibility of developing one or more artificially soiled fabrics for the evaluation of detergent efficiency. It was soon evident to the Committee that it would be necessary to develop standard washing and evaluation procedures. The Launder-Ometer was used because it is a standard machine of the AATCC, and nearly all laboratories of the textile industry have one. The Launder-Ometer also has the advantage of having the capacity to permit running 20 replicates at once.

While reflectance measurements are generally accepted as the best means of evaluating test results, there was no standardized procedure for carrying out such measurements. It was, therefore, necessary to develop a standard procedure of reflectometry suited to the Committee's needs.

The Launder-Ometer procedure and the method for measuring reflectance were developed using an artificially soiled cotton fabric available from Test Fabrics, Inc. This soil is printed on cotton sheeting to leave part of the cotton unsoiled. The unsoiled portion of the fabric was originally intended for measurement of redeposited soil. The Committee decided to confine its efforts to the measurement of soil removal because single cycle wash tests, using a high ratio of water to test fabric, do not simulate practice with respect to redeposition. A high water to fabric ratio (40 to 1) exists in the Launder-Ometer procedure developed by the Committee. The Committee realizes that redeposition of soil is as important as the removal of soil in many evaluations of detergents. However, it seemed impractical to develop soil removal and redeposition tests simultaneously.

The measurement of reflectance required standardization with respect to—

1—The wave length of light employed

2—The calibration of the reflectometer

3—The use of multiple layers of test fabric

4—The area and orientation of sample tested

5—The method of reporting data.

While absolute reflectance values may not be essential to the calculation of percent return to original whiteness, they are sometimes helpful in determining the reasons for lack of correlation between laboratories. The elimination of background effects are especially important since they include the porosity of the test fabric. The porosity of a fabric will change with shrinkage during washing.

The selection of an artificially soiled standard fabric posed a difficult problem. There are many reasons for doubting that a single standard can ever be developed. There is a possibility that several types of standard soils would serve to evaluate detergents for many end uses.

The Committee decided to investigate the soiled fabrics available from various sources. No attempt was made to prepare artificially soiled fabrics. Unfortunately, when the work of the Committee was started, only two soiled cotton fabrics were commercially available. Only one of these (Testfabrics) was obtainable in 1950 when the first reliable set of data was obtained. The data obtained prior to 1950 showed poor reproducibility between laboratories. This was primarily due to the lack of a standard method of reading reflectance.

The improved correlation between laboratories obtained in the 1950 tests led to the investigation of the same soil applied to a variety of fibers other than cotton. The purpose of this work was to learn how the same soil would react to detergents on different substrata.

The investigation of soiled fabrics must include the effect of water alone in the Launder-Ometer. A water value was obtained for the various soiled fabrics. One fiber (silk) showed a very high degree of soil removal by water alone; all other fibers showed a negligible degree of soil removal.

LAUNDER-OMETER PROCEDURE USED BY THE COMMITTEE

A) Preparation of Soiled Test Samples

Cut test fabric pieces measuring 3½ x 8 inches so that half of the piece is soiled and half is white. Number each test sample by marking in one corner with a washfast ink.

B) Reflectance of Test Samples

Use a green filter with reflectometers, such as Hunter and Photovolt. Make readings at 525 mμ when a recording spectrophotometer is used. Back each test piece with three other pieces from the same set when making reflectance readings. Orient the warp

and filling in the same direction for all readings.

Calibrate the reflectometer before use by means of the set of standards available from the Committee chairman. Report corrected reflectance values only.

C) Water

Use distilled water.

D) Detergents

Use 0.25% detergent.

Use the following detergents supplied by the Committee:

an alkyl aryl sulfonate coded "D"[1]

soap (42° titer, 88/92%) coded "E"[2]

Run 10 replicates for each detergent.

Prepare the stock solutions of detergents at 104° F using a convenient concentration to insure uniform sampling. Use the solutions the same day they are prepared.

[1]Excelsior Flake Soap 40-42° Titer 88/92% Laurel Soap Mfg Co, Philadelphia, Pa

[2]Nacconol NR Flake
National Aniline Div
Allied Chemical & Dye Corp
New York, NY

E) Washing Procedure

Place ten ¼-inch stainless steel balls in each pint Launder-Ometer jar. Add 200 ml of 0.25% detergent solution to each jar. Adjust the temperature of the solution in the jar to 160° F for cotton and 120° F for the other fibers. Add one piece of soiled cloth and one piece of white cloth to each jar. Close the jars and test for leakage by inverting each jar.

Rotate the jars at 42 rpm in the Launder-Ometer for 30 minutes at the temperature of the test. Check the rpm with the full load to account for possible belt slippage.

Pour the contents of each jar successively into a colander suspended over the sink. Dump the test samples from the colander into a pail of distilled water heated to 110° F. Stir for one minute, remove the test samples individually and place them on a clean flat cloth towel. Blot the pieces by placing a clean towel over them and pressing lightly by hand. Iron the swatches dry at 225-250° F with either a hand iron, flat bed press, or a mangle with the soiled side facing away from the iron. Do not let the surface of the iron come into direct contact with the test samples. Use clean towels and a clean iron. Condition the dried test samples overnight in the atmosphere.

F) Reporting Results

Measure the reflectance of each test sample and code the data as follows:

W_0—Reflectance of white sample before washing

S_0—Reflectance of soiled sample before washing

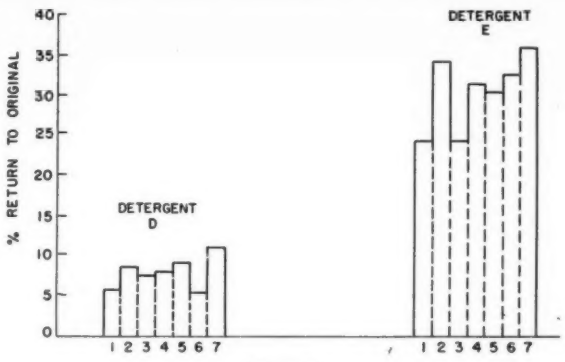

Figure 1
Detergency results on cotton from seven cooperating laboratories

TABLE I
Artificially soiled cotton fabric
Average values of 20 replicates

Cooperating Laboratory	W_0	S_0	S_1	% Return
	Data on Detergent D			
1	84.19	16.82	20.55	5.6
2	81.78	16.45	21.96	8.4
3	83.58	17.19	21.86	7.0
4	88.04	18.00	23.10	7.4
5	80.60	14.55	20.55	8.7
6	81.90	16.90	20.40	5.3
7	82.45	14.65	22.49	11.6
	Data on Detergent E			
1	84.19	16.82	33.16	24.2
2	82.13	16.25	39.07	34.7
3	82.88	16.60	32.76	24.2
4	88.20	17.95	40.21	31.7
5	81.60	14.76	35.64	31.2
6	82.92	16.97	38.92	33.3
7	82.34	14.42	38.82	35.9

W_1—Reflectance of white sample after washing

S_1—Reflectance of soiled sample after washing

Calibrate the percent return to original whiteness as follows:

$$\% \text{ Return to original} = \frac{S_1 - S_0}{W_0 - S_0} \times 100$$

Include the reflectance figures for each test sample as well as the average in the report.

EXPERIMENTAL RESULTS——The work is divided into two sets of tests called Test A and Test B. The first tests were made on the soiled cotton by seven cooperating laboratories using two detergents. Test B was carried out on 8 soiled fabrics of different staple-fiber content by nine laboratories using the same two detergents.

Test A

The averages of experimental data obtained are given in Table I and Figure 1.

Test B

The averages of data obtained in Test B are given in block form in Figures 2, 3, 4 and 5.

STATISTICAL STUDY

SUMMARY——For Test A involving the comparison of soap and Detergent D by twenty tests in each of seven laboratories on cotton, the following conclusions may be drawn:

1) The simple statistic, $S_1 - S_0$, is as useful as the more complicated statistic, $\frac{S_1 - S_0}{W_0 - S_0}$ for measuring the effectiveness of the detergents.

2) The sample coefficient of variation, $s/\overline{X}$, seems appreciably more constant than the standard deviation, s, of the statistic, $(S_1 - S_0)$. Setting aside the more variable results from Laboratory No. 6 the average coefficient of variation for all other laboratories is 0.143.

3) Noting the constant coefficient of variation, and the variation among

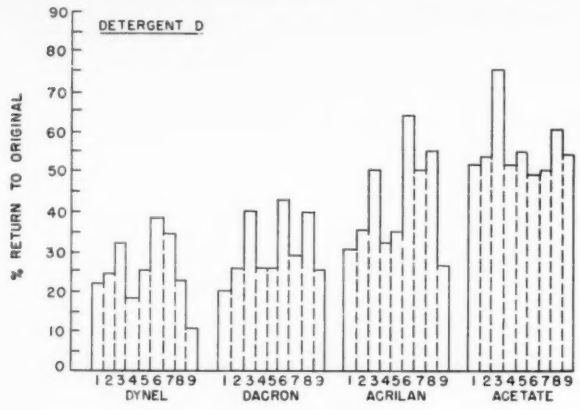

Figure 2
Detergency results from nine cooperating laboratories

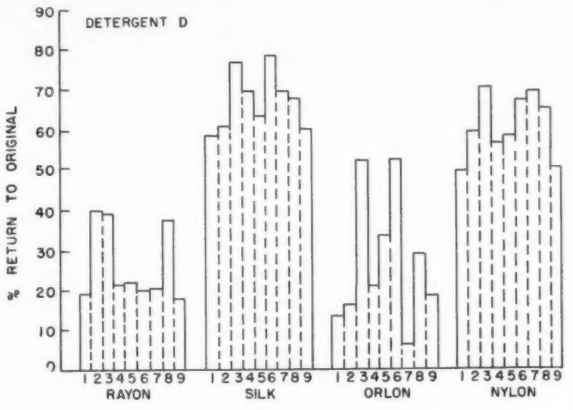

Figure 3
Detergency results from nine cooperating laboratories

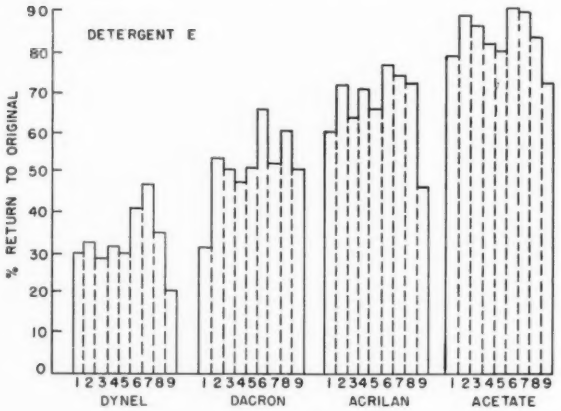

Figure 4
Detergency results from nine cooperating laboratories

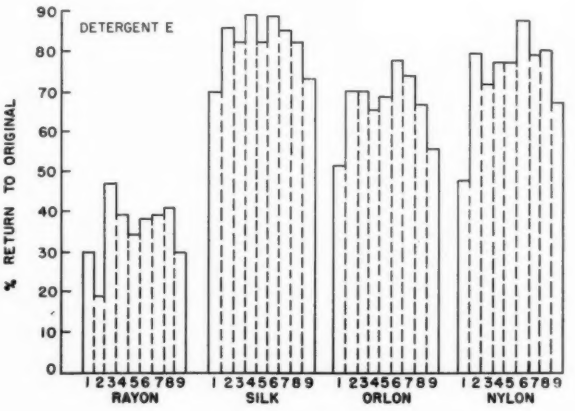

Figure 5
Detergency results from nine cooperating laboratories

laboratories, the following formulas are suggested for *approximate* confidence limits. Denoting

$$R = S_1 - S_0 =$$

value observed in a sample

the 95% confidence limits for the difference in the "true" values of R are:

for two samples of 20 each taken at the same laboratory:

$$\text{Confidence Limits} = R_1 - R_2 \pm .09\left(\frac{R_1 + R_2}{2}\right)$$

for two samples of 10 each taken at the same laboratory

$$\text{Confidence Limits} = R_1 - R_2 \pm .125\left(\frac{R_1 + R_2}{2}\right)$$

for two samples of 20 each taken at the same laboratory where "standard" detergent is also tested by samples of 20 each at both laboratories

$$\text{Confidence Limits} = (R_1 - \text{R Std}) - (R_2 - \text{R Std}) \pm .125\left(\frac{R_1 + R_2}{2}\right)$$

It is suggested that two detergents not be compared without a standard if the two are to be tested one at each of two laboratories.

For Test B involving the comparison of soap and Detergent D for eight fabrics by ten measurements at each of eight laboratories, the following conclusions may be drawn:

1) The constant coefficient of variation was not noted for B that was noted for A. The precision of B was about one half the precision of A.

2) As in A, comparisons should be made between detergents at a single laboratory as there is a laboratory to laboratory source of variation.

3) Soap shows a higher percent return to original for all fabrics; however, the amount by which it exceeds the value of Detergent D varies from fabric to fabric.

4) In Test B, but not in A, the sets of ten swatches must have been handled together in some way to introduce a source of variation among sets of ten which is not present among swatches with sets of ten. One possible explanation is that Test B was a much larger and longer experiment so that all methods and conditions may not have been held as constant as they were during the smaller Test A.

5) Assuming that the source of variation contributing the excess variability among sets of ten can be

eliminated in a shorter or more closely controlled experiment, the precision of this test may be stated in the following manner. Denoting

$$r = \frac{S_1 - S_0}{W_0 - S_0} =$$

percent return noted in sample

the 95% confidence limits for the difference in the "true" value of r are:

for two samples of 20 each taken at the same laboratory,

$$\text{Confidence limits} = r_1 - r_2 \pm 5$$

for two samples of 10 each taken at the same laboratory,

$$\text{Confidence limits} = r_1 - r_2 \pm 7$$

The reason for the simpler form of the confidence limits is that the assumption of constant standard deviation rather than constant coefficient of variation seems more reasonable from the data in this experiment.

Supplementary information supporting the conclusions concerning Test A are given in Table II.

From Table II it may be noted that the coefficient of variation is more stable than the standard deviation. It may also be noted that the coefficient of variation is approximately the same for both statistics, indicating the desirability of using the simpler one, R. A scatter diagram of S_1 against W_0 indicates no detectable regression—this is further evidence that the more complicated statistic, r, is not necessary.

While this conclusion suggests a logarithmic transformation for the entire analysis, and the corresponding type of confidence limits, it was felt that this more rigorous use of the information that the coefficient of variation was constant was not warranted for routine calculating procedures. Therefore, approximate confidence limits of the form given for Test A (3) in the first part of this summary are suggested.

Supplementing calculations for Test B given below.

From the experiment involving eight laboratories, eight fabrics and two detergents, the following analysis of variance table may be calculated.

Source of Variation	Degrees of Freedom	Mean Square
Laboratories	7	5,633
Detergents	1	115,993
Fabrics	7	48,960
Detergent × fabric interaction	7	4,457
Variation among sets of ten	105	658
Variation within sets of ten	1152	64

Three broad conclusions may be drawn from this table.

1) Comparisons should be made among test results within laboratories, since an additional source of variation is introduced by making comparisons of two detergents where the two are studied at different laboratories.
2) Although soap shows a higher percent return to original for all fabrics, the amount by which it exceeds the value for Detergent D varies from fabric to fabric.
3) In addition to the variation introduced in measuring percent return on ten successive samples, in the processing of the swatches, sets of ten must have been handled together in some way, to introduce another source of variability due to this processing or handling. That is, a variation is introduced into each set of ten at one time somewhere in the processing, in addition to the variation among the individual swatches in a set.

While of less interest, it may also be noted that there are significant differences in the percent return among different fabrics, although the amount of difference between fabrics varies in going from soap to Detergent D.

Further calculations give us more information concerning Paragraphs 1 and 3 above. The variance components in this experimental situation are estimated to be:

$S_1^2 = 31$ variance component due to laboratories

$S_2^2 = 59$ variance component due to differences among sets of ten

$S_3^2 = 64$ variance component due to differences among determinations within sets of ten

To illustrate the implication of these quantities, consider the following experimental situations.

a) In a manner similar to that followed in this experiment, one set of ten determinations is made on each of two detergents in the same laboratory. The precision of that difference is obtained by calculating:

Variance (difference)

$$= 2\,S_2^2 + S_3^2$$

$$= 118 + 12.8 = 130.8$$

that is the precision associated with the observed difference is:

Observed difference $\pm 2\sqrt{130.8}$ equals Observed difference $\pm$ 22.9

b) In a similar manner to that followed in this experiment, two sets of two determinations is made on each of two detergents in the same laboratory. The precision of that difference is obtained by calculating:

Variance (difference)

$$= S_2^2 + S_3^2$$

$$= 59 + 64 = 123$$

that is the precision associated with the observed differences is:

Observed difference $\pm 2\sqrt{123}$ equals Observed difference $\pm$ 22.1

c) In a manner similar to that followed in this experiment, two sets of ten determinations are made. One set on Detergent A in Lab I and one set of Detergent B in Lab II. The variance of the difference of these two averages is then given by:

Variance (difference)

$$= 2\,S_1^2 + 2\,S_2^2 + S_3^2$$

$$= 62 + 118 + 12.8 = 192.8$$

that is the precision associated with the observed difference is:

Observed difference $\pm 2\sqrt{192.8}$ equals Observed difference $\pm$ 27.8

TABLE II

Values of Sample Mean, Standard Deviation and Coefficient of Variation for Two Statistics

$S_1 - S_0 = R$			Laboratory and Detergent	$\frac{S_1 - S_0}{W_0 - W_0} = r$		
$\bar{X}$ (R)	s (R)	s/$\bar{X}$ (R)		$\bar{X}$ (r)	s (r)	s/$\bar{X}$ (r)
3.73	.9021	.24	(1) D	5.56	1.386	.25
16.34	2.4270	.15	E	24.22	3.480	.14
5.52	.3437	.06	(2) D	8.43	1.640	.20
22.82	3.2790	.14	E	34.65	2.818	.08
4.67	.8367	.18	(3) D	7.03	1.236	.18
15.98	2.3090	.14	E	24.16	3.450	.14
5.18	1.2420	.24	(4) D	7.40	1.783	.24
22.26	2.5850	.12	E	31.67	3.655	.12
6.00	.8766	.15	(5) D	8.71	1.121	.13
20.82	2.1520	.10	E	31.22	3.195	.10
3.45	1.5120	.44	(6) D	5.29	2.315	.44
19.70	7.4750	.34	E	33.27	5.167	.16
7.84	.8931	.11	(7) D	11.56	1.335	.12
24.66	1.9616	.08	E	35.94	7.319	.20

Paragraph 2 may be supplemented by the following tabulation:

MEAN VALUES OF PERCENT RETURN

Fabrics	Detergent Soap	Detergent D	Difference
Dynel	34	28	6
Dacron	52	31	21
Acrilan	69	45	24
Acetate	81	58	23
Rayon (viscose)	36	27	9
Silk	84	68	16
Orlon	68	28	40
Nylon	75	62	13

It may then further be noted that the precision of these differences is $\pm$ 8.

No study was made of the use of the statistic S_1—S_0 in Test B. There is no reason, however, why the simpler statistic should not be useful here also.

ACKNOWLEDGMENT

The Standard Soils Committee is indebted to S L Andersen and A E Hoerl of the Engineering Service Division of E I du Pont de Nemours & Co, Inc, for performing the statistical study so essential in this report. The committee is also indebted to George Gewinner, Mohawk Carpet Mills, for a statistical appraisal of earlier unreported work.

The following organizations participated in the cooperative tests along with laboratories of the Committee members:

Alrose Chemical Co
American Cyanamid Co
Colgate-Palmolive Co
Lowell Technological Institute
Monsanto Chemical Co

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To ensure that the activities of your Section receive proper publicity in the Proceedings, it is desirable that material be submitted direct to American Dyestuff Reporter, 44 E 23rd St, New York 10, N Y.

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Advance notices should include the date and site of the meeting; the speaker's name, position, business affiliation, and subject; a short abstract of the paper (optional); details of additional meeting highlights, eg, nominations or election of officers, special awards, activities of Sectional committees, etc.

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EXECUTIVE SECRETARY—ASSISTANT TREASURER'S FINANCIAL REPORT, OCT 25, 1956

	Applications	Dues, regular & reinstate	Dues, Corporate & Sustainng	Miscellaneous	Totals
Received and transmitted to Treasurer					
August 1 through September 7, 1956.....	360.00	124.00	225.00	1091.09	1800.09
September 8 through October 23, 1956....	498.00	9592.00	1095.00	1102.61	12287.61
Total received & transmitted to October 23..	858.00	9716.00	1320.00	2193.70*	14087.70
Leaving deposited by Treasurer with Executive Sec'y—Asst Treasurer Oct 25...	147.00	3910.00	——	1413.00	5470.00

Miscellaneous items,	
Reporters and reprints	25.58
Year Books	119.50
Crockmeters	961.68
Crock Cloth	6.60
Water Test Apparatus	44.50
Dyed Standards	577.00
Knitted Tubing	64.40
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Application of Vat Dyes	122.95
Gray Scales	21.09
Accelerotor Liners	25.00
Perkin Centennial Proceedings	70.00
Receipts from Canadian members to cover exchange rates	.65
	2193.70*

G P Paine, *Executive Secretary-Assistant Treasurer*

Minutes———

Two Hundred and Third Meeting of the COUNCIL

THE Council held its 203rd meeting at the Waldorf-Astoria, New York, NY, 7:45 PM, Wednesday, September 12, 1956.

1) *Present* were President Raymond W Jacoby, presiding; Vice Presidents Joseph H Jones, Walter M Scott and Frederick V Traut; Albert E Sampson, treasurer; Charles W Dorn, chairman, Executive Committee on Research; Past Presidents J Robert Bonnar, Carl Z Draves, Henry F Herrmann, and P J Wood; George O Linberg, Frank J Rizzo and Robert D Robinson representing Northern New England; Francis H Casey, Ernest J Chornyei, Edward H Gamble and Raymond B Taylorson representing Rhode Island; Bernard K Easton representing Niagara Frontier; Irwin J Smith representing Hudson-Mohawk; Robert C Allison, Matthew J Babey, William F Brommelsiek, Percy J Fynn, William A Holst, Paul J Luck and Donald E Marnon representing New York; Arthur W Etchells, Thomas H Hart, Thomas R Scanlan, Jr, Clarence A. Seibert and Richard A Shirp representing Philadelphia; Lawrence I Heffner representing Washington; A Henry Gaede representing Piedmont; Robert B Hallowell representing Southeast; Eric W Camp representing Mid-West; Hubert A DesMarais representing Pacific Northwest; James A Doyle of the Publicity Committee, Ernest J Finan; G P Paine, executive secretary and assistant treasurer and Richard R Frey, assistant secretary.

2) *Minutes 201st Council Meeting*: Mr Frey stated than an amended report of the 201st Council Meeting had been circulated and approved by letter ballot.

3) *Minutes 202nd Council Meeting*: The secretary's report of the 202nd Council Meeting was accepted.

3-A) *Committee Appointments*: The president noted that Dr Chapin's resignation had left certain vacancies on committees and offered in nomination for these appointments W A Holst as chairman of the Constitution and Bylaws Committee; G P Paine as chairman of the Technical Supplies Committee and member of the Publicity Committee.

A motion was made and seconded that the nominees be appointed. The motion was adopted.

4) *Secretary's Financial Report*: The secretary's financial report of July 31, 1956 was accepted.

5) *Treasurer's Report*: The treasurer noted that his report for the year ending July 31, 1956 had been circulated by mail to the members of the Council. He expressed the hope that the Councilors had given it consideration and study and that they had talked it over with their Section members. Assets on a cost basis showed $396,105.51, an increase of $40,302.12 over assets at the close of the previous fiscal year. The Association's liabilities were the same as the previous year, namely the *Colour Index* contract, requiring a commitment of $85,000 The treasurer stated this would be discussed in the report of the *Colour Index* Marketing Committee. Operations during the year had required some minor adjustments in the budget figures as the year proceeded. Expenditures of $128,276.27 were $6,310.69 over the 1954-55 expenditures, mainly due to $2,367 in research salary increases, $1,848 in Section membership allowances, $667 in Employees' Group Life Insurance and $2,592 in the purchase of technical supplies for re-sale. There were some substantial decreases which offset the other minor increases. At the present time, operating costs are $10,000 a month. The treasurer asked the Council to join with him in commending the chairmen and their committees for the very economical operation indicated by the figures.

On the matter of cash, he stated that the balance in the checking account at the end of the year was $29,029.15. This represented the amount on noninterest-bearing funds maintained in checking accounts equal to about three month's operating reserve. Cash in checking accounts was no longer allowed to reach up to $100,000 as previously and some $2,000 in interest was accumulated during the last fiscal year.

Returns on investments were $10,641.07 which on a cost basis, figures about 3½%. Considering the fact that the portfolio contains quite a few governments, the return was creditable and in substance considerably more owing to stock splits and stock dividends of such companies as American Gas and Electric, The Insurance Company of North America, Atchison, Union Pacific, General Dynamics and others. In viewing the over-all situation, the treasurer noted that 22.8% or $88,524.09 was in cash and savings banks; 47.6% or $186,913.38 in U S Bonds and 90-day certificates; 27.3% or $111,668.04 in common stocks; 2.3% or $9,000 in loans and expense accounts.

A motion was made by the treasurer and seconded that Price Waterhouse and Company be appointed auditors for the Association for the fiscal year 1956-1957, to be so advised by the executive secretary. The motion was adopted.

A motion was made by the treasurer and seconded that the Council instruct the treasurer to bring to the sum of $10,000 the monies deposited in the Middlesex County National Bank in Lowell, Mass, in the executive secretary-assistant treasurer's account, said account to be the checking account for that officer and that he be instructed to deposit periodically any sums in excess of that amount of $10,000 in the treasurer's account at the First National Bank of Boston, Massachusetts. The motion was adopted.

A motion was made by the treasurer and seconded that George P Paine, executive secretary-assistant treasurer be authorized to sign checks for withdrawal of funds to pay Association obligations from the executive secretary-assistant treasurer's account, Middlesex County National Bank, Lowell, Massachusetts, to become effective September 13, 1956 and that he be bonded by the Seaboard Surety Company in the sum of $10,000. The motion was adopted.

A motion was made by the treasurer and seconded that the Middlesex County National Bank, Lowell, Mas-

sachusetts be authorized to accept the signature of Richard R Frey on the executive secretary-assistant treasurer's account and to have Richard R Frey bonded in the sum of $10,000 to cover said authorization. The motion was carried.

The treasurer recalled that at the June meeting of the Council, he had distributed a specimen accrual sheet to the members of the Council for discussion with the members of their Sections for an opinion as to its adaptability to their needs. He requested an expression of opinion on the relative merits of the cost and accrual methods of accounting. A discussion followed. The auditors had said it was customary to present financial reporting on an accrual basis. The treasurer stated that the accrual method indicated among other things market values rather than cost of securities, thus reflecting current values based on market quotations. He pointed out that while he generally favored reporting on an accrual basis, the present system was less complicated and facilitated comparison of figures over the past 23 years that the cash method had been in use by AATCC.

A motion was made by the treasurer and seconded that the treasurer be instructed to have prepared and mailed to each member of the Council prior to the November meeting, the statement of July 31, 1956 in accrual form, together with comments for discussion at the November meeting of the Council. The motion was adopted.

A motion was made and seconded that the treasurer's report be accepted. The motion was adopted.

6) *Reports of Vice Presidents:* J H Jones, Mid-West Region, stated that there had been no recent meetings but that he would be able to report on the Mid-West meeting in October at the next Council meeting. E R Kaswell, New England Region, was not present. W M Scott, Southern Region, said there had been no meetings in his Region. F V Traut, Central Atlantic Region, reported that the Philadelphia Section had planned a large meeting to be held on September 28th in Reading, Pa, which would include plant visits.

7) *Organization Committee:* Henry F Herrmann stated that, while he had no formal report of the Committee, he wanted to say that the action taken at the last Council meeting had resulted in a very smooth transfer of duties to the new executive secretary-assistant treasurer. President Jacoby took occasion to welcome the executive secretary to his first Council meeting in his new capacity.

8) *Appropriations Committee:* Mr Sampson referred to the June Council meeting when it was voted that the Appropriations Committee take such action as might be needed to protect the Association's funds should any sudden need arise, the steel strike, Cyprus and various disturbances being near at hand. Inasmuch as the Commonwealth of Massachusetts required Form 482 for transfer of securities of corporations, it was necessary to have these forms completed before the Committee on Appropriations could adjust its portfolio. While the present portfolio was excellent, the views of investment authorities indicated some changes could be made in the interest of greater safety, improved growth and some $2,000 per year increased return.

A motion was made by Mr Sampson and seconded that the Council instruct the executive secretary to sign forms signifying the Council voted on this date to authorize the Committee on Appropriations to sell securities owned by the Association at its discretion. The motion was adopted.

9) *Archives Committee:* In the absence of S M Edelstein, President Jacoby stated that he, Mr Edelstein and Mr Paine had met at noon with Mr Schiff, president of the National Records Management Council and his associate, Mr Rice, and that the NRMC would draw up a basic plan outlining recommended steps for organizing and preserving the records of the Association.

10) *Constitution and Bylaws Committee:* President Jacoby offered in nomination Ernest R Kaswell to membership on the Committee and George P Paine as ex officio. A motion was made and seconded that the nominees be appointed. The motion was adopted. As previously noted (3A) W A Holst was appointed chairman.

11) *National Research Advisory Committee:* No report.

12) *Subject and Speakers Bureau Committee:* M J Babey reported progress in obtaining new subjects. In particular, he cited a letter from B F Goodrich Company which expressed a wish to exchange speakers with AATCC. He stated that section chairmen have been requested to send him addresses of new section program chairmen and that only a few had responded. It was planned to circulate a list of speakers and subjects every six months and more frequently if there were something of great importance.

13) *Intersociety Relations Committee:* It was noted by C Z Draves that appointments to represent AATCC in other societies had not been regularized. A report would be made at the November meeting of the Council on the progress of relations with other societies. Appointments would appear in the forthcoming *Year Book.*

14) *Executive Committee on Research:* C W Dorn reported on a meeting held that morning which discussed a possible project under consideration on infrared heat treatment for drying textiles. ECR would study the matter further for discussion at its next meeting. The Piedmont Section had suggested a research project on radioactive techniques in the wet-finishing industries. The Section is being asked for more details. A report on the recent meetings of committees of the International Organization for Standardization (ISO) will be published in detail at a later date. ECR had requested an additional $1,000 for further study of daylight exposure tests. This had been granted. L S Thompson of General Dyestuff Company, Division of General Aniline and Film Corp, had been approved as a member of TCR.

15) *Textile Education Committee:* President Jacoby reported that H A Rutherford had been endeavoring to carry out plans presented in his first report. He had aroused a great deal of interest and enthusiasm but he had found that the idea of a cooperative undertaking had not met with encouraging response.

16) *Publicity Committee:* A publicity manual had been prepared for use by AATCC Sections. J A Doyle stated that it had been well received. The manual outlined the aims and purposes of the Association's publicity with suggestions and samples of sources, media and manner of presentation of the material for editors. Copies would be circulated to the Council. The Publicity Committee had been active in its program. It had been cooperating with the Perkin Centennial Publicity Committee in extending news coverage in the daily press, magazines and trade publications. He said that press representatives of publications in other countries had been interested in obtaining information on the Centennial. The Centennial press rooms in the Waldorf-Astoria had been very active in supplying requests of reporters and correspondents. Mr Doyle noted that three Sections had not appointed publicity chairmen and urged that these vacancies be filled. President Jacoby asked J Doyle to contact the vice presidents to follow up on the matter as it applied to their Regions.

17) *Publications Committee:* While there was no report of the committee, W M Scott said that action had been taken by letter ballot to identify hydron blue as a vat sulfur blue and list it in the *Year Book* to conform with the identification used in the *Colour Index*. He said he had received a letter from Mr Cady calling attention to the section of the *Year Book* dealing with the identification and quantitative separation of fibers which was out of date. Dr Scott had contacted a representative of Committee D-13 in ASTM and arrangements were being made to form a joint committee to bring these methods as nearly up to date as possible and to have Committee D-13 and AATCC methods in accord. Committee D-13 had been contacted because of the lead that its Subcommittee B-1 was taking in the development of a number of new methods for identification of fibers in mixtures.

18) *Membership and Local Sections Committee:* Since last June, the Membership Committee had received applications for 51 Senior memberships, 2 Junior, 22 Associate, 8 Student, 2 Corporate and 14 applications for transfer to Senior membership. J H Jones stated that the applications were in order.

A motion was made and seconded that the following be added to the membership of AATCC. The motion was adopted.

SENIOR

C F Anthony
E P Beatty
R Bernstein
J J Boyce
C W Brown, Jr
J B Carpenter, Jr
P C Chen
J E Coldren
W F Crowell, Jr
A G Dabal
F J Dombik
E W Dunham, Jr
R M Esteve, Jr
A Fischler
D C Fitton
P J Frickert, Jr
E J Furlani
W S Gammon, Jr
C E Garland
L F Gendron
A C Groce
J B Hackett
R C Hand
A J Hawkins, Jr
W W Heckert
C B Hill
I E Kauffman
R S Kenyon
D Kolodny
H T Lacey
J P Leach
J J Leavitt
L O Leenerts
L Lembcke
Q R Madaris
M B Mandle, Jr
F B Mayer
G A Molloy
C H Monk
J G Montano
J E Mullinax
J Nigro
J E Nolan
F Palazzolo
D T Pan
J M Perry
W F Pond
U S Samarotto
W L Sharp
G F Shepard
D A Shiraeff
H St Laurent
C T Simpson
J C Solmonese
M J Spangler
C K Stansell
F G Strakele
R B Steeves
B G Stumberg
J H Tew
M G Thruston, Jr
R N Williams
H Wilson
J M Wood
J A Yoma

JUNIOR

R B Gunter
H L Parker
P D Turits

ASSOCIATE

G M Behar
B Bernat
A H Brown
L C Estes
L F Fanning
L P Finnegan
P R Gelzer
D Gevert
R P Goncalves
R A Gopel
W S Grottle
G D Hawkins
F W Howe, Jr
R K Ink
H R Kitchens
J F Luther
J B Malloy
R A Marshall
W H Rhyne
O A Rodriguez
S Schatzberg
J C Schoop
S Shirasaki
V Starhan
R A Supper
W S Truette
D J Voss

STUDENT

R M Bones
M F Davis
H J Emore
R H Keenan
A M McArthur
T A Polak
E J Sheppard, Jr
R L Slowik
R D Turner
M B Waits, Jr

Transferred from other Classifications to Senior

J S Birch
R G Curtis
J E Farrington
F A Flynn
J E Hall
H F Mahoney
R A McGurren
R R Metzinger
J Y Papineau
W J Ratcliffe
G M Riggiola
E Rychalski
I Safdeye
E A Schlaginhaufen
A J Trentesaux
P R Tully
J W Whitworth
L Zeldis

19) *Perkin Centennial:* G O Linberg commented on the variety of papers listed in the Centennial Program and noted the attendance at the sessions which thus far had been generally good. H F Herrmann stated that it was too early to predict the financial outcome of the Committee.

A motion was made by Mr Sampson and seconded that the Appropriations Committee be authorized to advance $2,000 to the Perkin Centennial and that the president forward a check for $8,000, previously drawn but not deposited, to the treasurer of the Perkin Centennial Committee. The motion was adopted.

20) *National Convention Committee:* G O Linberg reported that the Niagara Frontier Section had asked that the 1961 National Convention be held in Buffalo. The National Convention Committee had voted 5 in favor, 2 opposed and one to postpone decision, the chairman abstaining.

A motion was made by P J Wood and seconded that the 1961 National Convention be held in Buffalo. The motion was adopted. Considerable discussion followed on hotel space and general facilities available. Mr Easton provided detailed information on a number of questions.

21) *Corporate Membership Committee:* C W Dorn, reporting for A E Johnson, said that total receipts from corporate and sustaining membership payments to date was $61,785. This represented 284 corporate membership renewals totaling $53,020; 46 new corporate members at $8,100; 66 sustaining memberships of $665. There were 9 unpaid totaling $950; 17 resignations amounting to $1,875. One new member at $100 was on the books but not yet paid. Mr Dorn stated that the new edition of the corporate membership certificate had been printed at a cost of around $1 a certificate.

22) *Colour Index Marketing Committee:* A very encouraging response to the mailing of the return postcard requesting further information on the *Colour Index* was reported by A E Sampson. Several associations, societies and companies had circulated the card. This promotion effort was being continued. Advice from The Society of Dyers and Colourists indicated that Volume I of the *Colour Index* would be issued in December, 1956; Volume II in January, 1957, possibly December 1956; Volume III in early spring of 1957; Volume IV in late summer or early fall of 1957. Mr Sampson planned to confer with Clifford Paine, president of the Society within the next few days to obtain if possible data on final cost, final price, the SDC solicitation plan, method of protecting initial subscribers, information on deliveries, duties, discounts. Such information had not been made available direct from SDC.

23) *Colour Index Editing Committee:* W A Holst said that Volume I was in press, Volume II was being proofread. Very little of Volume III was available.

24) *Unfinished Business:* None

25) *New Business:* None

Adjournment: A motion was made and seconded that the meeting adjourn. The motion was adopted and the president declared the meeting adjourned at 9:30 PM.

Respectfully submitted,
G P Paine
Executive secretary

ACTIVITIES OF THE LOCAL SECTIONS

New York—Head Table at November 16th Meeting

(See report, page P926, December 3rd issue)

(L to r): **John H Hennessey, Berkshire Color & Chemical Co, councilor and sectional committeeman; Matthew J Babey, American Cyanamid Co, councilor and chairman, technical program; Eugene Allen, American Cyanamid Co, who spoke on "Fluorescent White Dyes: How They Work and How They are Evaluated"; Donald E Marnon, American Aniline Products, Inc, chairman; Warren B Reese, Macbeth Daylighting Corp, who spoke on "The Fundamentals of Lighting"; Raymond W Jacoby, Ciba Co, Inc, president, AATCC.**

Pacific Northwest

A REGULAR meeting of the Pacific Northwest Section was held at the Aero Club in Portland, Ore on November 16, 1956.

Twenty-six members and three guests attended the meeting, which was preceded by a cocktail hour and steak dinner.

Under old business, there was a brief discussion of the suggestion offered by Earl Fuller, fabric designer at Jantzen, Inc at the April meeting regarding the development of interest among young men of this area in the textile industry.

Under new business, it was decided to introduce subjects and activities outside of the textile field to meetings at any time that adequate material was not available from the industry itself. The meeting was adjourned immediately after the election of officers for 1957 and a brief but amusing acceptance speech by the new chairman.

The results of the election were as follows:

Chairman—Tom B Kay, Jr, Thomas Kay Woolen Mills

Vice Chairman—Bernard R Koenig, Portland Woolen Mills

Secretary—Frederick H Ihlenburg, National Aniline Division, Allied Chemical & Dye Corporation

Treasurer—Dale W Kimsey, Geigy Dyestuffs, Division of Geigy Chemical Corporation

Counselor—Hubert A DesMarais, Verona Dyestuff Division, Verona Chemical Company

Sectional Committee — Richard R Beaudoin, Charles E Bouthillier, Theodore M Marshall and Paul Pernice

(L to r): **James J Farrell, American Aniline Products, Inc, chairman, registration; Joseph J McGuinness, Dexter Chemical Corp, chairman, publicity; Richard E Miller, Eastman Chemical Products, Inc, treasurer; Richard P Monsaert, Jr, Puritan Piece Dye Works, secretary; Michael F Costello, Jacques Wolf & Co, chairman, membership.**

(L to r): **Sidney M Edelstein, Dexter Chemical Corp, national chairman, AATCC Archives Committee; Weldon G Helmus, Fair Lawn Finishing Co, sectional committeeman and vice president elect, AATCC; Norman A Johnson, Howes Publishing Co, Inc, secretary of the Publications Committee, AATCC; Paul J Luck, Peerless Color Co, Inc, councilor and sectional committeeman.**

Piedmont

WARREN E RIXON, secretary of the Piedmont Section, has announced the following 1957 meeting dates:

Winter Meeting: January 26, Poinsett Hotel, Greenville, SC

Spring Meeting: March 30, Hotel Roanoke, Roanoke, Va

Summer Outing: June 7-9, Mayview Manor, Blowing Rock, NC

Annual Meeting: September 28, Hotel Barringer, Charlotte, NC

Abstracts

Soaping Vat Dyeings

Anon, *Ciba Rev* **114**, 33-6, April, 1956.

Vat dyeings are soaped after the dyeing process in order to develop the final shade, to ensure the best possible fastness, and to remove any loose surface color.

Experience has shown that soaping should be carried out at the boil. The higher the temperature, the quicker the development of the shade takes place. The time required for complete development varies according to the constitution of the dye.

If soft water is available, soap and soda ash are generally used, but if the water is hard, a synthetic detergent or dispersing agent is desirable.

The author gives instructions for soaping in various types of equipment (circulating machines, jigs, and winches) and by continuous methods.

A table is included in which the change of shade is given for all of the Ciba and Cibanone dyes after soaping, both for one minute and for 30 minutes. A comparison of the two readings will show whether the shade of a dye is completely developed in one minute or requires more time.—WHC

"Courlene" X.3

Anon, *Textile Mfr* 82, 370, July, 1956.

A new type of monofil of polyethylene, known as Courlene X.3, is being developed by Courtaulds Ltd. Compared with the earlier Courlene, the new fiber is said to have greater strength, resistance to abrasion, and a higher melting point. Its strength is comparable to that of nylon. It softens at about 120°C and melts at approximately 135°C.

According to the manufacturers, Courlene X.3 absorbs no moisture, is almost completely resistant to all acids and alkalies at normal temperatures, is unaffected by mildew, insects or bacteria, has high electrical resistance, is tough, is very light for its bulk, and having a sp gr below 1.0, will float on water. It is also flexible at sub-zero temperatures. By virtue of its special properties, particularly its strength and heat resistance, Courlene X.3 can be used for producing fabrics which, unlike those made from the earlier Courlene, are stable in boiling water, provided that the fabrics have been suitably finished.

Recommended uses for the new fiber include protective clothing for chemical workers, filtration cloths, car seat covers and other upholstery fabrics, and ropes. It is expected to be available soon in spun-dyed colors.

A table of its physical and chemical properties is included.—WHC

Lurex

Anon, *Textile J Australia* **31**, 193, April, 1956.

Lurex is a metallic yarn produced by the Dobeckmun Co of Cleveland, Ohio. It comprises a fine aluminum foil core, sandwiched between two layers of clear elastic film by means of a special permanent adhesive. This yarn is available in a wide range of colors (some 20 in all), the dyes being applied to the adhesive in the form of pigments.

Among the claims made for this new yarn are its resistance to tarnishing and light, its relatively soft and pliable hand, and its ability to withstand washing (up to 150°F).

For knitting, a twist of Lurex with a suitable supporting yarn is recommended, to obtain adequate strength.

A certain amount of specialized knowledge is required for the dyeing of fabrics containing Lurex. It must be borne in mind, for example, that all acetate dyes will dye Lurex, and that the yarn will also be affected, though to a lesser extent, by union dyes. Dyebath temperatures must be kept below 180°F; higher temperatures and friction tend to delaminate the yarn. Wool and Lurex yarns can be scoured and dyed by the normal methods applicable to wool.

The yarn is offered in four widths at present, from 1/100 to 1/32 in.—WHC

The Dyeing and Finishing of Cellulose Triacetate Yarns and Fabrics

Mellor, A and Olpin, H C, *J Soc Dyers Col* **71**, 817-28, December, 1955.

The authors refer to the widespread interest in the properties of cellulose triacetate that has been aroused in recent years, and mention the research studies conducted by the Celanese Corporation of America over a period of 20 years.

The triacetate fiber is now produced under four different names, "Arnel," "Courpleta," "Trilan," and "Tricel." The properties of the fibers described in this paper refer specifically to Tricel.

The authors give a summary of the general chemical and physical properties of Tricel fibers, and note particularly their resistance to alkalis in the strengths normally used for scouring and dyeing, and to delustering in boiling soap baths. They may be heat-set before or after dyeing, either with dry heat at 190-250°C or with wet steam at 120-145°C. They do not shrink or contract during heat-setting.

Dyeing is normally carried out with Disperse dyes. A list is submitted of dyes having good or very good substantivity at 90°C; other dyes require a higher temperature. Addition of a suitable swelling agent (diethyl phthalate is recommended) improves the substantivity. Ordinary (secondary) acetate, however, has a greater dye uptake with all disperse dyes.

Regarding fastness, most disperse dyes have the same fastness to light and gas fading on Tricel as on secondary acetate, but the dyeings on Tricel are said to be faster to washing at 60°C, particularly when heat-set.

Fast colors on Tricel are produced with diazotized and developed disperse dyes and by azoic combinations, in much the same way as on secondary acetate. A list of suitable combinations is included.

The authors give full instructions for handling Tricel fabrics in the various wet-processing operations. Sodium chlorite is preferred for bleaching, but any of the usual bleaching agents may be used. Zinc sulfoxylate formaldehyde is recommended for stripping.

The authors also discuss the dyeing of Tricel in admixture with other fibers (secondary acetate, wool, nylon, and Terylene).

Printing Tricel with disperse dyes requires the addition of solvent-swelling agents. Vat dyes may be applied by the Manofast process.

In finshing, the authors recommend a silicone treatment to give a durable wash-fast proofing.—WHC

New Cellulosic Fibers and Their Relation to the Chemical Industry

McFarlane, S B, *Can Textile J* **73**, 51-5, August 10, 1956.

The author discusses the newer cellulosic fibers offered by the Celanese Corp of America: Arnel and *Fortisan*-36.

Arnel triacetate is closely related to regular acetate, and has many of the same properties (eg, hand, drape, dyeability); but as far as physical properties are concerned, and espe-

cially those encountered in wearing and in the care of these fabrics, "Arnel is as different from acetate as any other fiber is from acetate."

A distinction must be made between Arnel as it comes from the manufacturing plants and heat-treated Arnel in the fabrics used by the consumer.

The effect of heat treatment (at 240°C) is to increase the softening and melting point of the fiber, decrease the moisture regain and increase the drying rate, reduce swelling and shrinkage, and improve the dimensional stability and wrinkle recovery.

The heat treatment also increases the diffusion of dye into the fiber, thereby improving the washfastness and resistance to gas fading. When the dyed fabric is washed in contact with a white fabric, the white is said not to be stained.

According to the author, a colored garment of Arnel can be laundered in a household washing machine, tumble-dried in a home-type dryer, and is ready to wear without ironing Furthermore, it can be washed repeatedly with little or no damage. Arnel can, however, be ironed with safety, when necessary, because of its high melting point of 572°F.

For dyeing, a wide variety of disperse dyes can be used. The author states, however, that there is a need of more dyestuffs in the lower price range having the necessary fastness properties.

Fortisan-36, formerly known as X-36, is a highly oriented, regenerated cellulose. It is claimed to be the strongest of all fibers, man-made or natural. It appears to have both military and industrial applications (eg. armor cloth and V-belts).—WHC

Artificial Light Sources Used in Fading of Dyes

Desai, N F, *Colourage* 3, 69-71, August, 1956.

Since the testing of dyes as regards their fastness to actual sunlight is not only slow but involves several variable factors, many intense artificial light sources are being used to hasten the fading reaction and to get fairly reproducible results.

There are three types of artificial light sources generally used for fading tests: 1) carbon arc lamps; 2) mercury discharge lamps; 3) tungsten filament lamps. The carbon arcs are usually employed alone; mercury discharge lamps may be used either alone or in combination with tungsten filament lamps. The latter are not used by themselves.

Carbon Arc Lamps. These are made in three types: flame arcs, low-intensity arcs, and high-intensity arcs. Flame arcs may be of the open or enclosed type. They operate either on AC or DC, and are so arranged that a large proportion of their radiation comes fom the flame.

In low-intensity arcs, the radiation is obtained from the crater on the positive electrode. This consists of a stick of pure carbon, or one in which there is a small core containing no light-emitting materials, but only salts having a steadying influence on the arc. The lamp functions satisfactorily only on DC. The Fade-Ometer and Fugitometer both employ the low-intensity arc. These lamps are described by the author.

The positive electrode of a high-intensity arc consists of a carbon rod having a core about half the diameter of the rod, containing a high proportion of rare earth compounds, principally the fluorides of the cerium and lanthanum group. This arc also burns on DC, and the current density in the positive carbon is comparatively high, about 3½ times that of the low-intensity arc. This lamp has been used for fading tests by H Hunter.

Mercury Vapor Discharge Lamps. In this type of lamp, an electric discharge passes through mercury vapor confined in a transparent bulb or tube of glass or silica.

Tungsten Filament Lamps. These consist of a coil of tungsten wire mounted in a glass bulb which usually contains a certain amount of inert gas. The wire is heated to incandescence by the passage of on electric current.

A German fading lamp, combining the mercury vapor and tungsten filament lamps, is described by the author.

In still another rapid testing apparatus, known as "Heliotest", light from the sun is collected by lenses and concentrated on the patterns to be tested, so as to give a 25-fold increase in intensity. It is claimed that the results are "highly consistent" with those obtained by the normal method of sun exposure.—WHC

Recommended Conditions for Fading Lamp Operation

Light Fastness Subcommittee (SDC), *J Soc Dyers Col* 72, 369-70, August, 1956.

The Light Fastness Subcommittee of the Society of Dyers and Colourists has been investigating the problem of why many lightfastness determinations made in fading lamps differ significantly from exposures made in daylight. A detailed discussion of the possible causes was published in the Society's Journal, December, 1954, when the view was expressed that the greatest discrepancies would occur when there are wide variations in the effective humidity of the air surrounding the pattern and standards during exposure.

In daylight testing in Great Britain the average effective humidity is about 20%; exposures of humidity-sensitive patterns made in fading lamps operating at lower values will give results which are higher than those obtained in daylight, while those made at higher values will give lower results.

The Committee describes the following fading lamps employing the carbon arc that have been used to date: the Fade-Ometer, Models C, CV, FDA and FDA-R; the CPA Fading Lamp; and the Fugitometer, 1924, 1928, 1945 and 1953 Models. Their comments on the latest Fade-Ometer and Fugitometer models are perhaps the most important.

Fade - Ometer, Model FDA-R. These lamps are humidified but not screened (to remove heat), and should be operated under the conditions recently specified by the makers (Am. Dyestuff Reptr. *43,* 628, 1954). These give the highest effective humidity possible with this type of lamp, but even so, the value is only 5-10%, as the surface temperature is about 60°F higher than the air temperature. The effective humidity is therefore too low to duplicate British daylight conditions. This effective humidity (5-10%) is very close to that occurring in the AATCC Sunlight Test, which the lamp is intended to duplicate.

Fugitometer, 1953 Model. This lamp is equipped with a glass and water screen, to filter out the heat from the arc, and is humidified. It should be operated so that the air in the exposure chamber has a rh of 30±10%; this can be measured with a wet-and-dry-bulb thermometer with the bulbs shielded from direct radiation from the arc.

The Committee concludes that exposures in carbon-arc fading lamps, even under the preferred conditions of effective humidity, must not be regarded as always equivalent to daylight testing, but rather as a means of obtaining a fairly reliable indication of the actual lightfastness when time does not permit a daylight exposure to be made. The practice of expressing lightfastness in terms of the number of hours of lamp exposure necessary to produce a certain amount of fading is completely unsatisfactory; assessment should always be made against standards exposed simultaneously. —WHC

• PATENT DIGEST •

PAUL WENGRAF

AFTERTREATMENT OF DIRECT DYEINGS———Guanidine-Formaldehyde Condensates

USPat 2,736,749 (Arnold, Hoffman——Robinson ——Feb 28, 1956)

The preamble to this specification states that the washfastness of direct dyeings can be improved by many dye-fixing agents, including formaldehydeguanidine condensates, which have been partially satisfactory but *not adequate to give outstanding results* as required by the AATCC wash test #3.

Surprisingly, a guanidine-formaldehyde condensate of superior fixing quality has been developed by specific changes in the conditions of condensing the two components. The condensation should be as mild as possible: if the condensation is carried out at 80°C (as the highest permissible temperature) the reaction time must not exceed 15 min; a half hour condensation at 80°C produces a somewhat inferior fixing agent, while a definitely poor product results when the reaction is continued at this temperature for one hour. When lower temperatures, such as 20-35°C, are employed, the reaction time has to be extended to 6 hours or more, even up to 20-24 hrs.

After the reaction is completed, the condensate may be solubilized, for instance, by adding an acid (hydroxyacetic acid is preferred) to bring the product to the acid side. The solubilized compounds are applied at a rate of 1% (calculated solids on the weight of the cloth . . Col 5, line 22). It is preferable to combine the condensate with soluble copper compounds.

Example: 1.0 mol guanidine hydrochloride was added to an aqueous solution of 0.95 mols sodium hydroxide, followed by the addition of 2.1 mols formaldehyde (in 37% solution). The reaction mixture was warmed to 50°C for one hr while being stirred. After the pH was adjusted to 6.5-7, the liquid was refluxed for 10 min and cooled thereupon. The clear, colorless solution obtained was used for aftertreating a cloth previously dyed with a substantive dyestuff in a bath containing 7.5% of the above condensate (calculated from the fabric's weight) for one half hour. The washfastness upon exposure to the severe AATCC test #3 was found to be excellent.

Among the references cited by the Patent Office:

USPat 1,780,636 (Du Pont/1930) describes the condensation of formaldehyde and guanidine at various temperatures, which results in clear liquids, syrups or hard resins, according to temperature conditions.

USPat 2,093,651 (Widmer——Pierce/1937): using formaldehyde condensates with guanidine or other nitrogenous bases as dye-fixing agents.

USPat 2,322,333 (Ciba Co/1943): comparatively highly condensed hydrophobic condensates of formaldehyde with nitrogenous bases are claimed to be good fixing agents provided they are used in a concentration less than 5%.

Brit Pat 429,209/1935: lower condensation stages (thus, water-soluble hydrophilic condensates) of formaldehyde with nitrogenous bases are preferred as after-treating agents for direct dyeings and prints.

USPat 2,362,915 (Courtaulds/1944): improving the fastness of direct dyes by applying a condensate of formaldehyde with an adipate or sebacate of a diaryl guanidine, eg, diphenylguanidine.

USPat 2,462,428 (Ciba Co/1949): pretreatment of *glass fibers* with formaldehyde condensates of guanidine or similar nitrogenous bases to render them dyeable with dyes containing sulfonic acid groups [cf *Am Dyestuff Reptr 38*, 424 (1949)].

SETTING OR STIFFENING NYLON FABRICS——— Heating with Amphoteric Metal Salts G,2,04

USPat 2,734,001 (Brit Nylon Spinners——Mecklenburgh et al——Feb 7, 1956)

It is well known that nylon must be subjected to a heat-setting operation to preserve the smoothness of the fabric and to avoid wrinkle formation during subsequent wet treatments.

Greater stiffness of knitted or woven goods in addition to the usual set is frequently required, for instance, in the manufacture of shoes, collars, laces, marquisette fabrics or the like. According to the current invention, the double effect of setting and stiffening is attained by a preparation with an aqueous solution of amphoteric metal salts (Sn, Zn or Al), the anion being a volatile inorganic acid (nitric or hydrochloric acids), followed by heating. Temperatures lying 10-170° C below the melting point of the nylon substance have to be maintained in this step.

Example: Nonset knitted nylon fabrics were cut into equal squares and impregnated with 10% zinc chloride solution, then fixed on a pin frame and subjected to oven temperatures of 116°C for 10 min, 140°C for 5 min, and 160°C for 2.5 min. The respective area shrinkages were: 7.1%, 3.0% and 0.3%. The resulting fabric was found to have an attractive stiff finish, stable to washing.

Among the references cited by the Patent Office:

USPat 2,157,119 (Du Pont/1939): preboarding of knitted goods containing nylon yarns, subjecting them to a hot liquid treatment, and thereafter reboarding the goods.

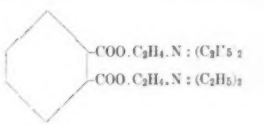
USPat 2,251,508 (Du Pont/1941): increasing the coefficient of friction of nylon filaments by a treatment with an acid or acid halide (sulfuric acid or sulfurylchloride) and removing the acid before the fiber substance can be weakened.

FUMEPROOFING OF CELLULOSE ESTERS——— Di(dialkylamino)-Phthalates G,1

USPat 2,736,631 (Celanese Corp of Am——Myles ——Feb 28, 1956)

Agents that have been hitherto advocated for the prevention of gas-fading of sensitive colors, such as those of the amino anthraquinone group, frequently have the tendency to discolor themselves when exposed to acid fumes and to turn yellow.

A compound which will protect these dyes from fading while at the same time remaining colorless upon exposure to acid coal-combustion gases has been found in the group of alkyl-substituted di(alkylamino) phthalates. Two products proved to be particularly good inhibitors: di(diethylamino ethyl) phthalate (I)



and the homolog di(dimethylamino propyl) phthalate.

These compounds can be incorporated into the cellulose acetate solution before it is extruded into fibers,

or applied to dyed cellulose ester material. In the latter event, the agent may be used in the form of an organic solvent solution (toluene or benzene), optional also in form of an emulsion. The effect is improved by allowing the treated fabric to stand before drying in a J box. The washfastness is increased by steaming the goods before or after drying at 100-115°C preferably under pressure.

Example: A cellulose acetate fabric, which had been dyed a pastel shade with a blue anthraquinone dye, was padded for one min at about 40°C with an emulsion of the product I (see above) dissolved in a mixture of 60% toluene, 20% ethylmethyl ketone and 20% "Emulphor ON" (ie, a condensate of a polyethylene glycol with a long-chain fatty alcohol). The pressure of the padding mangle rollers had to be adjusted so as to leave in the fabric after drying 1% of the product I. The resistance to acid fading was improved by letting the impregnated goods stand for 30 min in a J box before drying. Better washwastness was attained by a steam treatment under pressure with saturated steam (10 min at pressure of 7 psi).

Among the references cited by the Patent Office:

USPat 1,914,945 (Celanese Corp of Am/1933): improving the acid fastness and light fastness of anthraquinone dyes on cellulose acetate substrate by incorporating an alkali salt, such as borax or sodium carbonate.

USPat 2,094,809 (Celanese Corp of Am/1937): aromatic compounds substituted by acidylamino or acid amide groups are described as gas- and acid-fading inhibitors.

USPat 2,539,212 (Gen Aniline & Film/1951): resistance to gas fading is attained by using aromatic substituted dialkylethylene diamines, eg, dibenzyl dimethyl ethylene diamine.

Brit Pat 613.818 (Drewitt and Stephens/1948): increasing the affinity of cellulose acetate for acid dyes by a treatment with various polyalkylene polyamine derivatives.

WOOL-LIKE FINISHES ON CELLULOSE———Formation of Acid-Nitrogen Complexes, Alkali Aftertreated G,1

USPat 2,709,638 (Jos Bancroft & Sons Co——Babiarz, Hall——May 31, 1955)

Several US patents, assigned to this company and probably covering the "Banflame" flameproofing process, are based on a simultaneous reaction of phosphoric acid and urea upon cellulosic fiber material. The preamble to the current patent mentions, among others, US Patents 2,482,755 and 2,524,783 (Ford and Hall—see references below). It is assumed that a cellulose-acid-nitrogen complex results from heating of the components, thereby imparting durable flameproofing effects. This reaction has been thoroughly studied by Davis, Findlay and Rogers (see reference).

In contrast to the flameproofing effects obtained by methods outlined in the aforementioned and copending patents, the inventors observed that quite different finishes can be produced by treating the fibers containing the cellulose-acid-nitrogen complex *with strong alkalies*. In this reaction the nitrogen is removed and replaced by alkali metal. The material so treated reportedly has a wool-like, soft and flexible hand and a "warmth of feel ordinarily exhibited only by woolen fabrics." At the same time a certain degree of creaseproofness is noticed; the effects are said to be durable. Therefore, the treatment of fabrics according to one of the previous Bancroft patents is a prerequisite of the current process.

In the patented method, the material in which the acid-nitrogen complex has been formed is treated with an aqueous caustic soda solution of approximately 30% for 45 seconds at room temperature. Even lower concentrations, down to 10% NaOH, are permissible, especially in handling viscose fabrics. The treatment may take place with or without tension; in the latter event, the wool-like touch is said to be further accentuated. The caustic-impregnated fabric should be carefully washed until alkali-free, generally with a sodium bicarbonate solution. It is emphasized that this process differs from customary mercerizing in that the alkali is firmly complex bound within the fibers and can no longer be washed away by rinsing. Formation of a *cellulose-acid-sodium complex* has been shown by analysis (Col 5, lines 52-55 and Col 7, lines 31-36).

As an alternative, the caustic soda treatment may be replaced by a treatment with compounds having *swelling* and alkali-substituting properties. Examples of this type of compound are solutions of caustic cupro ammonium, sodium zincate or supercooled caustic (min 10° C). Various softeners may be added. *Aldehydes* can be employed *in the first phase* (forming the acid-nitrogen-cellulose complex) to render the final effects more durable.

Example: The formation of a nitrogen complex within the fibers by a treatment with a solution of phosphoric acid-dicyanodiamide-urea plus formaldehyde is followed by baking. The fabric is washed and treated in a mercerizing machine with 30% NaOH, rinsed (while sodium bicarbonate is added), dried and aftertreated with a cationic softener. The hand reportedly is soft, full and wool-like; moreover, good crease-resistance may be observed.

Among the references cited by the Patent Office:

USPat 1,666,083 (Heberlein Pat Corp/1928): production of wool-like finishes on cellulose by a treatment with mineral acids in the presence of heterocyclic N-compounds (pyridine).

USPat 2,286,726 (Du Pont/1942): flameproofing by impregnation with polyethylene imine solution followed by reaction with acidic fire-retarding agents, such as phosphoric acid.

USPat 2,459,222 (Secy Agric/1949): introducing of amino groups into cellulose by treating with lye (of mercerizing strength) containing amino ethyl sulfuric acid and baking [see *Am Dyestuff Reptr* 38, 477 (1949)].

USPat 2.473,308 (Rohm & Haas/1949): rendering cellulose fibers less receptive to dyes, making them stronger and stiffer, by a treatment with strong alkalies (15%) and then with acrylonitrile solutions. Increased *adsorption of nitrogen* is claimed [cf *Am Dyestuff Reptr* 38, 659 (1949)].

USPat 2,482,755 (Bancroft & Sons/1949): flameproofing with a mixture of strong inorganic acids (phosphoric acid) and a nitrogen-containing organic compound, such as urea, biuret, a guanidine derivative, etc.

USPat 2,524,783 (Bancroft & Sons/1950): production of antimicrobial finishes by formation within the fibers of an acid-nitrogen-cellulose complex similar to that described in USPat 2,482,755.

USPat 2,530,261 (Courtaulds/1950) (also Brit Pat 634,690): improving the flame- and crease-resistance by a treatment with a strong mineral acid (phosphoric or sulfuric acids) combined with a small amount of cyanamide and then baking.

USPat 2.603.551 (Courtaulds/1952) refers to US Pat 2,530,261. A *water-soluble yarn* is produced by treating cellulose (rayon) with sulfuric acid, ammonium sulfate and cyanamide.

Davis, Findlay and Rogers [*J Textile Inst 40*, Transactions, 839-54 (Dec, 1949)] investigated the flameproofing methods covered by the Bancroft patents. They are said to have found that a minimum content of 3% P (on the cloth's weight) was required for flameproofness. They concluded that diammonium pyrophosphate is formed, acting as a flameproofing agent in the presence of urea. Regarding the N-removing reaction with caustic alkali (as covered in the current patent), they state that the original flameproofing effect is lost (paragraph 7, page 844 T). The specific finishing effects claimed in the pat-

ent, where N is replaced by alkali, are not mentioned in this article.

PRINTING CELLULOSE ACETATE With Water-Soluble Dyes ———Thiocyanate Impregnation D,2,07

USPat 2,699,373 (Brit Celanese——Olpin, Jackson ——Jan 11, 1955)

Certain patents assigned to Celanese Corp advocate the use of swelling agents, such as alcohols combined with a thiocyanate, for printing nondispersed, particularly water-soluble acid dyes on cellulose ester fibers. The specification mentions US Pat 2,428,836 (see reference below) and 2,514,410, both assigned to Celanese Corp of America. The latter reference [cf *Am Dyestuff Reptr 40*, 64 (1951)] advocates the thickening of the strong alcoholic solution with methyl cellulose.

Although these methods were found to work satisfactorily in most cases, it has been observed that thiocyanate, when applied in higher concentrations as required for obtaining full shades, frequently becomes insoluble in the cold printing paste. Also, weakening of certain areas has been noticed when one thiocyanate-containing printing paste falls over another. This disadvantage may be caused by excessively high thiocyanate concentration, resulting in strong plasticization of the fabrics in overlapping areas.

The current method reportedly solves this problem by first incorporating 3-7% (preferably 4-6%) of a thiocyanate in the fabrics before printing. Alkali-, ammonium-, alkaline earth-, Mg- or Zn- thiocyanate may be employed; ammonium thiocyanate is preferred in the samples.

Water-soluble dyes that have affinity for cellulose acetate, such as acid and direct mordant, vat and disperse, reportedly can be printed with good yield on fabrics when prepared with thiocyanate. Thus the process avoids local overcharging with thiocyanate while the presence of the necessary amount of fixing agent is ensured.

Example: A cellulose acetate fabric is padded with an aqueous (8%) solution of ammonium thiocyanate, squeezed to a pick-up of 50-75%, and dried. A paste containing Crocein Scarlet 3BS aind methylated spirit thickened with aqueous 4% methyl cellulose solution is used for printing; the fabric is steamed for 40 min at 225° F, rinsed cold and soaped at 60° C, rinsed and dried.

Among the references cited by the Patent Office:

USPat 2,133,470 (Celanese Corp of Am/1938): a cellulose acetate fabric is blotch printed with water-soluble colors and cross printed with a thiocyanate paste. After steaming and washing, only the dyes in the overlapping areas are fixed.

USPat 2,428,836 (Celanese Corp of Am/1947): printing of cellulose acetate with pastes containing an acid dye, a lower alcohol, a lower aliphatic acid and an inorganic thiocyanate [cf *Am Dyestuff Reptr 37*, 397 (1948)].

Brit Pat 599,055 (Brit Celanese /1948): improvement of an analogous process as described in the preceding patent, comprising a subsequent steaming of the prints for better fixation.

Brit Pat 285,942 (Dreyfus/1928) refers to numerous patents, which advocate the use of swelling agents in the application of water-soluble dyes to cellulose ester fibers, and states that the dyeing and printing effects obtained *with disperse dyes* can also be improved by preswelling.

SHRINKPROOFING WOOL WITH PERMONOSULFURIC ACID———Controlled pH Values A2,04

USPat 2,701,178 (Stevenson Dyers——Fell——Feb 1, 1955)

Shrinkage control of wool can be effected with various oxidizing agents, among them monopersulfuric acid.

Particularly good shrinkproofing results are achieved, according to the present patent specification, by treating the goods at temperatures up to 50° C with this acid or salts thereof, either at pH values under 2 in the presence of strong sulfuric acid or at pH between 7 and 11.2.

Good hand and color as well as full shrinkproofness are said to be obtained; no fiber damage can be noticed.

Examples: An all-wool fabric is treated for 40 sec at 33° C in a bath containing permonosulfulric acid and sulfuric acid or in the cold for 30 min in a bath containing the sodium salt of permonosulfuric acid, adjusted with NaOH to a pH of 10.

Among the references cited by the Patent Office:

USPat 2,173,040 (Müller/1939): desizing of textiles with diluted solutions of permonosulfuric acid.

Ger Pat 561,521 (Carl Flesch Jr/1932): organic compounds of persulfuric acid, eg. p-toluene persulfonic acid, are used as oxidizing, bleaching and disinfecting agents, also for oxidizing of starch products.

French Pat 784.828 (1935) and 798,566 (1936) (E Franz): bleaching of fibers with oxidizing baths, among them. monopersulfates and monopersulfonates.

Brit Pat 451 026 (E Franz/1936): bleaching of wool with peroxide or peracids or salts thereof (among them, permonosulfuric acid or salts thereof). The baths are adjusted to a pH lower than 7 by the addition of aliphatic acids.

Further reference is made to Brit Pat 692,258 (Stevenson Dyers) reported in *Am Dyestuff Reptr 42*, 620 (1953), which may be parallel (or at least very similar) to the current USPatent.

SHRINKPROOFING OF WOOL ———Emulsions of Copolymers of Acrylic Acid and Amido-Acrylic Acid Esters

USPat 2,719,072 (Rohm & Haas——Kine——Sept 27, 1955)

While the shrinkproofing of wool with resinous products and emulsions thereof has been suggested frequently in the past, the current patent covers a method which is said to produce superior effects and resinous products that apparently become chemically bound to the fibers, resulting in finishes that are fast to washing and drycleaning.

One of the components (a) invariably applied in the emulsifiable mixtures of monomers is *ureido ethyl acrylate* $CH_2{=}CH.COO.C_2H_4NH.CO.NH_2$ or the corresponding methacrylate. The other compound (b) is an alkylester of acrylic acid or methacrylic acid. Methacrylic esters were found to give a harsher hand to the finished products than did the acrylic esters. The amount of (a) should be 2-10%, preferably 3-8%, of the mixture.

These monomers are agitated in an aqueous solution of an emulsifier, mainly a nonionic agent (in the examples, an Igepal-type product) at room temperature. The polymerizing redox-catalyst may be a mixture of potassium persulfate and sodium metabisulfite or any other appropriate combination of oxidizing and reducing substances. Textile goods impregnated with this emulsion should retain, after drying, 3-12% of the polymer, calculated from the material's weight. Thereafter the fabrics are heated for a short time, ie, about 2-15 min to 240° F or more. The addition to the emulsion before impregnation of 1-2% of a strong acid or an aldehyde accelerates the reaction and reportedly improves the stabilizing effect.

Example: The emulsion comprised 95.5 g ethylacrylate and 4.5 g ureido ethyl methacrylate, 288 g water and 8.6 g of tert octylphenoxy polyethoxy ethanol. The redox-catalyst consisted of 0.12 g ammonium persulfate and 0.16 g sodium hydrosulfite. This emulsion was diluted to a 5% resin content. A table presents comparative results of tests carried out with and without curing at 300° F after drying at 240°

F, adding oxalic acid to the emulsion and aftertreating the specimens with formaldehyde. Obviously, the addition of a strong acid, curing at 300° F and aftertreating with aldehyde substantially improves the shrink-resistance.

Among the references cited by the Patent Office:

USPat 2,355,265 (Rohm & Haas/1944): a stabilizing treatment of textiles, comprising the application of a reaction product of formaldehyde and an alkyl-substituted malonamide followed by curing above 100° C.

USPat 2,599,653 (Am Cyanamid/1950): shrinkproofing of wool by applying a polymerizable mixture of maleic anhydride and an acrylic acid ester [cf *Am Dyestuff Reptr 39,* 338 (1950)].

USPat 2,606,810 (Am Cyanamid/1952): shrinkproofing of wool by impregnating with copolymers of glycidyl esters of unsaturated acids and other monomers, such as ethylacrylate, styrene, etc [cf *Am Dyestuff Reptr 42,* 213 (1953)].

USPat 2,661,313 (Monsanto Chem Co/1953): shrinkproofing of wool by using aqueous colloidal solutions containing alkylethers of methylolmelamine plus water-soluble organic acids [cf *Am Dyestuff Reptr 43,* 446 (1954)].

BLEACHING NYLON——— Peroxygen Compounds plus Aliphatic Carboxylic Acids B,2

USPat 2,720,441 (Du Pont——Wallace——Oct 11, 1955)

The usual alkaline peroxide liquids are said to damage seriously the nylon fibrous substance; on the other hand, dilute aqueous solutions of *per-acids* have no practical bleaching effect.

The bleaching of nylon is carried out, according to the current specification, by application of a peroxygen compound and an aliphatic carboxylic acid having at 25° C a dissociation constant of 1.0×10^{-3} to 1.0×10^{-6}. Examples of the acids to be used in this process are: acetic, monochloroacetic, formic, tartaric, hydroxyacetic, etc.

Replacing one of the above aliphatic acids by an inorganic acid, such as sulfuric acid, gives a good bleaching effect, but the tensile strength is substantially impaired. The bleaching liquid must not contain less than 4% of the acid, the upper limit being 70% and the preferred concentration between 10-50%, dissolved in 90-50% water. Bleaching temperatures are between 35-85° and preferably between 50-70° C.

Example: 200 g of a bleaching medium containing 25% of acetic acid and 1% of hydrogen peroxide was obtained by dissolving glacial acetic acid and 35% hydrogen peroxide in water. Nylon gray goods were bleached in this liquid at 65° C for four hours. The brightness values, determined by a Hunter Reflectometer, were 84.5% against 71.9% for the nonbleached goods.

Among the references cited by the Patent Office:

USPat 1,767,543 (Pilot Labor Inc/1930): bleaching *rayon* with peroxidized organic acids.

USPat 2,442,332 (Celanese Corp of Am/1948): bleaching partly acetylated wood pulp with peracetic acid in presence of a Zn, Mn or Pb catalyst.

Brit Pat 451,026 (E Franz/1936): bleaching of wool with aqueous hydrogen peroxide in aqueous solutions of various aliphatic acids, excluding explicitly inorganic acids such as sulfuric, nitric or hydrochloric.

Brit Pat 451,115 (E Franz/1936): similar to the above, referring to oxalic, lactic or boric acids.

WOOL DYEING RESIST——— Sulfamic Acid Pretreatment C,4,06

USPat 2,726,133 (Sandoz A G———Helfenberger, Hagenbuch———Dec 6, 1955)

Several methods have been applied in the past to reduce the affinity of wool for acid dyes. The preamble to this specification mentions sulfuric acid and mixtures thereof with acetic acid or acetic anhydride, tannic acid, synthetic resins, etc. Disadvantages of these treatments include unsatisfactory effects, changes of the hand of the goods, unpleasant odors and high costs of the process involved

In contrast, the relatively simple patented method giving reportedly excellent resist effects comprises an impregnation of protein fibers with sulfamic acid . . . NH_2SO_2OH . . . whereupon excess liquid is removed and the material is dried at temperatures below 100°C; then the fibers are exposed to a heat of 120-175°C, rinsed and dried.

The temperature of the impregnating bath is given as 10-80°, preferably 20-40°C. Acid-resisting wetting agents of the alkylphenol-nonaethylene glycol (Igepal) or dodecyl benzene sulfonic acid type are useful additions as well as specific swelling agents, eg, urea, thiourea, formamide, etc. The heat treatment can be carried out at lower temperatures and in shorter time with the addition of urea; also, the solubility of sulfamic acid is considerably increased in the presence of urea, but amounts of more than one mol urea for one mol sulfamic acid are found to impair the tensile strength.

Example: Wool yarn was impregnated at 30°C with a 20% solution of sulfamic acid, containing 0.2 g/l of a water-soluble isooctyl phenyl polyglycolether. The wet pick-up was 45%. The goods were dried at 70-75°C and heated for 2 min to 160°C. After the rinsing and drying operations, the weight increase was found to be 6%, thus pointing to a chemical modification of the fiber. The yarns so treated were interwoven with nontreated wool yarns and the specimens dyed with acid dyes (Xylene Acid Milling Blue BR, Azo Acid Red L, Alizarine Yellow G, and many others). The sulfamic acid-pretreated portions remained colorless after dyeing.

Another example referring to *colored resist yarns* describes a treatment of wool yarns predyed with Alizarine Light Gray BS with 19% of sulfamic acid, 5% of urea and 76% of water. After being dried and heated for one hr to 105°C, rinsed and dried again, the yarn was interwoven with nontreated wool yarns and the sample dyed in a bath of Azo Rhodine 2G (*CI* 31). The final fabric showed pure red and gray threads.

References cited by the Patent Office:

USPat 2,146,116 (Soc Montecatini/1939): uniform dyeing of wool-casein blends with acid chrome dyes may be attained with a preliminary treatment with phosphoric acid. The same is true for a pretreatment with a dilute aqueous monosodium phosphate solution, according to the same Company's USPat 2,182,553 (1939).

Brit Pat 593,314 (R L Liggett/1937): a hair rinse consisting of a dye (dyestuff class not specified) and sulfamic acid as an assistant claimed to improve the shade of the hair.

Brit Pat 648,883 (Jos Bancroft & Sons/1951): rendering cellulosic or protein fibers flameproof using a combination of phosphoric acid and/or sulfuric acid/or sulfamic acid and aldehyde to the effect that a reaction takes place with the fibers (cf p 2, 60 and p 4 line 90 and foll) after curing; no change of dyeability is mentioned.

Cupery, in *Ind Eng Chem* 627-31, (1938) reports on sulfamic acid prepared on industrial scale from urea and fuming sulfuric acid. Reactions with organic and inorganic compounds are reviewed, eg, with amides forming the ammonium salt of the sulfonated amide. Reactions with proteins are not mentioned.

Gordon, in *Ind Eng Chem* 1237-8 (1939) refers to the foregoing article, while disclosing a number of other reactions, also applications in the flameproofing and leather processing field (USPat 2,142,115-6, Cupery).

News of the Trade

Cyanamid Announces Price Increases on Most Dyes

American Cyanamid Company will raise dye prices, effective January 1, 1957, according to an announcement made by V E Atkins, general manager of the Company's Organic Chemicals Division, on November 27th. In announcing increases of 18% on most Cyanamid dyes, Mr. Atkins cited constantly increasing costs for raw materials, labor, research and technical services as the factors necessitating the increases.

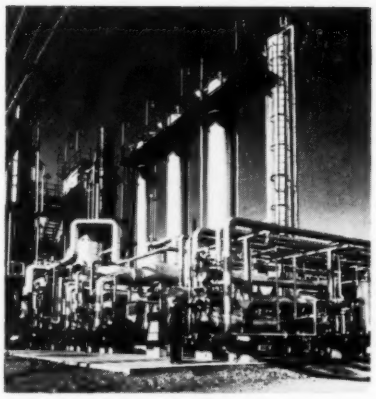
"We are fully aware," Mr Atkins said, "that these increases are being made at a time when competition in the dye industry is the keenest in history. They are, however, an economic necessity if American Cyanamid, as a major supplier, is to continue to provide its customers with the quality products and diverse services they need and want."

Increases in dyestuff prices in the past few years have been nominal, he pointed out, at no time affecting the entire dyestuff line and by no means offsetting the rapidly increasing costs of manufacturing and delivering dyes to customers. He cited Cyanamid's plant, research, development, application, standardization, quality control and technical services as cost factors to the company, yet factors that "insure to the dye consuming industries a continuing supply of quality products and maintenance of rigid specifications."

National Aniline Puts Major Isocyanates Plant on Stream

Successful start-up of a new multi-million dollar plant to produce Nacconates (tradename for National Aniline's organic isocyanates) at Moundsville, W Va, was announced earlier this month by Donald G. Rogers, president, National Aniline Division, Allied Chemical & Dye Corporation. The industry's newest and most modern isocyanate facility will add impetus to commercial urethane applications by assuring stable, large-volume supply of isocyanates at economic prices, Mr. Rogers said.

Constructed in record time, the plant occupies over 15 acres on National Aniline's 210-acre plant site on the Ohio River just south of Moundsville about 70 miles from Pittsburgh. Louis C. Goode, recently appointed plant manager of the plant to succeed the late Ross M. Sims, will also be in charge of the new isocyanates unit. Design and construction was supervised by F. J. Krueger, director, engineering and construction, National Aniline Division.



An important part of the operation at National Aniline's isocyanate plant at Moundsville, W Va, is this Girdler gas reformer unit which produces carbon monoxide and hydrogen from natural gas. The hydrogen is used for the catalytic reduction of nitrated toluene to diamine which is then phosgenated to form the diisocyanate. Carbon monoxide from the Girdler unit is reacted with chlorine from Allied's Solvay Process Division facilities at Moundsville to produce the required phosgene.

National's isocyanate plant is a completely integrated facility with all chemical raw materials supplied within the Allied Chemical group. Their basic position is further enhanced by the employment of technology developed during many years of dyestuff production using the same intermediates.

Under the tradename Nacconates, National Aniline has produced isocyanates in a substantial volume in its interim plant at Buffalo since early in 1955. The Buffalo plant will continue to produce new isocyanates developed at National's Buffalo Research Center.

Provision has been made at Moundsville for substantial expansions of the present plant. The plant has facilities for shipping by railroad, river barge or truck and loading equipment for any size container.

National Aniline Division recently announced a 50% price reduction on Nacconate 300 (MDI isocyanate) from $3.50 per pound to $1.75 per pound. This lowered price closely followed a price reduction on Nacconate 80 to 95¢ per pound. Both were based upon increased consumption and anticipated large-volume, low-cost production of Nacconate 80 and Nacconate 65 (both tolylene diisocyanate isometric mixtures) and Nacconate 300 (diphenylmethane 4,4¹ diisoyanate) at the new Moundsville plant.

Geigy Completes Move

November 26th saw the completion of the move of all divisions of Geigy Chemical Corporation from its quarters in New York to its new, modern offices and laboratories on Saw Mill River Road, Ardsley, NY, with the removal of Geigy Dyestuffs Division to its administrative offices and modern laboratories.

The three buildings, constituting an intact unit of operation, are devoted to executive and administrative offices, application and research laboratories and a cafeteria. The buildings designed by Skidmore, Owings and Merrill are modern in design, containing the latest developments in construction features. The administration building, 350 feet long, faces Saw Mill River Road with the laboratories building and cafeteria paralleling the administration building and interconnected therewith by glassed-in steel bridges.

This brings to one location all headquarters operations of the corporation serving the United States and Canada.

The corporation, a wholly owned subsidiary of J R Geigy S A Basle, Switzerland, will celebrate its 200th anniversary in 1958. Geigy, one of the oldest organizations in the dyestuff business, made its first synthetic dyestuff in 1859.

In addition to the dyestuffs that have come from its research laboratories, Geigy has introduced Mitin, a durable mothproofer, and many textile auxiliaries. The acquisition of Alrose Chemical Co of Cranston, RI, provided manufacturing facilities for a number of important industrial chemicals, including Tinopals, a series of optical bleaches or brightening agents for various textile fibers and paper.

The greatest development of the company has occurred since 1939, accelerated by the discovery of DDT insecticides. Following the establishment of the Agricultural Chemicals Division, Geigy Pharmaceutical came into being with Butazolidin, one of the leading antiarthritics heading an impressive list of ethical drugs.

Branches of the Geigy Dyestuffs Division are located in Philadelphia, Charlotte, Chattanooga, Chicago, Los Angeles, Portland, Ore, and Toronto, with the New England territory being served by modern offices, laboratories and warehousing in Newton Upper Falls, Mass.

Geigy has a financial interest in

the Toms River-Cincinnati Chemical Corporation with plants in Norwood and St Bernard, O and Toms River, NJ, where many Geigy dyestuffs are produced.

Industrial chemicals are manufactured in wholly owned plants in Cranston, RI, and McIntosh, Ala, with agricultural chemicals being produced as well in the latter plant.

"This is Color" Released by Interchem

A new motion picture dealing with the phenomenon of natural and manmade color has been released by Interchemical Corporation. It is believed to be the only movie in existence dealing with the physics of color.

Using animation and practical demonstrations, it shows that color is not a permanent characteristic of physical objects. Color depends on light and the nature of the human eye and colors change as the nature of light (tungsten, fluorescent, daylight) changes. One scene shows the five principle colors of the spectrum and the changes which take place when the light source is varied.

Produced by Wilding Picture Productions, "This Is Color" is a nontechnical film with sound which explains the qualities of refraction, reflection, transparency, opacity, subtractive mixtures and additive mixtures. In the film, these qualities are related to the behavior of light in industrial enamels, in textile colors, in four-color process printing and color television.

Since common household objects are used in the demonstrations and the narration is nontechnical, the film is of interest to many general audiences as well as scientific and industrial groups. Lew Wurzburg of Interchemical's Central Research Laboratories in New York, served as the film's technical director.

Filmed in Eastman Color, the running time is 27-minutes. Arrangements for borrowing this film may be made through Interchemical representatives, or through the headquarters of Interchemical Corporation, 67 West 44th Street, New York 36, NY.

New Site for DCAT Annual Meeting

A new location, at Galen Hall, Wernersville, Pa., has been chosen for the 67th annual meeting of the Drug, Chemical and Allied Trades Section of the New York Board of Trade, to be held September 19-21, 1957.

The new quarters will accommodate 500 guests.

Penny bank being used by Royce Chemical in promoting Vatrolite

Royce Promotes Product with Penny Banks

Penny-bank containers are being used by the Royce Chemical Co, Carlton Hill, NJ, to acquaint prospective customers with improved Vatrolite, the firm's granular concentrate of sodium hydrosulfite for vat dyeing and color stripping.

The novel celluloid containers are miniature versions of the red and gold 250-pound-capacity steel drums in which Vatrolite is supplied. White on red lettering bears the Royce trademark, company name and address and the product's name and chemical composition. In addition, the words "Dustless," "Free Flowing," "Uniform" and "Quick Dissolving" are starred to point up the chief advantages claimed for the product.

Royce Chemical Company salesmen are presently supplying the trade with the penny-banks, the Royce spokesman said.

NC State Planning Hart Memorial

Plans to establish a scholarship fund in the School of Textiles at North Carolina State College as a memorial to the late Prof. Thomas R. Hart are now underway. Alumni and other friends of the late college faculty member already have begun contributing to the fund, which will be used to finance scholarships for outstanding sophomores in State College's School of Textiles. Professor Hart was a member of the School of Textiles staff for 36 years prior to his death on January 10, 1956. At the time of his death, he was director of instruction in the school.

Hooker and Oldbury Stockholders Approve Consolidation

Stockholders of Hooker Electrochemical Co. and Oldbury Electrochemical Co. approved consolidation of Oldbury into Hooker at special meeting held Nov. 29 at the companies' respective headquarters in Niagara Falls, NY. The sonsolidation became effective Nov. 30. For the present, Oldbury will be operated as a division of Hooker.

The first directors' meeting for the consolidated company was held Nov. 30th, the new board consisting of the present 13 Hooker directors plus Earl L. Whitford, formerly president of Oldbury, who became a director and vice president of Hooker at the meeting.

Hooker produces five basic chemicals: chlorine, caustic soda, caustic potash, phenol and hydrogen, sold to industrial users and used by Hooker in its manufature of more than 100 other chemicals. The company also produces a broad line of phenolic and polyester resins and plastic molding compounds.

Oldbury is an important producer of phosphorus, phosphorus compounds, chlorates, perchlorates, oxalic acid and perchloric acid.

Oldbury began operations in 1897, while Hooker celebrated its fiftieth anniversary in 1955. Hooker has plants in six locations in the United States and Canada, while Oldbury has one plant located adjacent to Hooker at Niagara Falls, and one at Columbus, Miss.

Price of Rhoplex B-15 Reduced

A reduction of 2 cents a pound in the price of its acrylic emulsion, Rhoplex B-15, was announced by Rohm & Haas Company, effective November 20. New prices are as follows: Tanktruck and tankcar, 24 cents a pound; minimum truckload or carload, 26 cents; 400-pound drums, 26½ cents; lesser quantities, 36½ cents.

In the textile industry, Rhoplex B-15 is used as a binder for nonwoven fabrics, a backing for upholstery fabrics and in many fabric finishes.

Brouillard Addresses NYPC

Robert E Brouillard, General Aniline & Film Corp, addressed the New York Pigment Club at its regular monthly meeting on December 13th at Fraunces Tavern, New York, NY.

Dr Brouillard's topic was, "Phthalocyanine Blue'.

How fashion starts with the finish was the subject discussed by June Evans (left), public relations director, and Walter R Howell, Jr (right), executive of the Bradford Dyeing Association, of the Wendy Barrie TV show recently.

Miss Barrie (center) and her Bradford guests directed their efforts toward making the consumer more aware of the care and skill that goes into fabric finishing.

Actual garments, professionally modelled, were shown to point out the importance of proper finishing for longer and more satisfactory wear.

McK & R Chem Dept Establishes Cleveland Office

The chemical department of McKesson & Robbins, Inc. has established a new East Central district office at 4500 Euclid Ave., Cleveland, Ohio to direct the company's chemical distribution business in Ohio, Michigan and the western portions of Kentucky and Pennsylvania. Branch warehouses and sales offices will be maintained in Toledo, Detroit, and Pittsburgh as well as in Cleveland.

Robert D. Shaw has been appointed manager of the new district.

First Step in New FIT Building

More than 1,000 representatives of labor and management, city, state and education officials participated recently in the beginning of demolition activities for thenew Fashion Institute of Technology building on 27th Street, between 7th and 8th Avenues, New York. Governor Averill Harriman and Mayor Robert Wagner addressed the gathering. The ceremonies were presided over by Charles H. Silver, president of the Board of Education of the City of New York.

The occasion was an historic one—the Fashion Institute of Technology marks the first joint building project in the City of New York by the City and State. FIT is a two-year community college under the program of the State University of New York. It is sponsored by the Board of Education of the City of New York, in cooperation with the Educational Foundation for the Apparel Industry, and awards the Associate in Applied Science degree. The college prepares young men and women for creative and executive positions in the many fashion industries.

JCC Planning Major Expansion in Petrochemicals

A major expansion of its petrochemicals plant at Port Neches, Texas, has been started by Jefferson Chemical Company. The program is by far the largest undertaken by the Company since its formation in 1944.

It will increase production facilities for existing products, provide installations for the production of various raw materials now being purchased, and lead to the manufacture of several new products.

It is reported that Jefferson's expansion will triple production facilities for ethylene, used by the Company as a starting material in manufacturing numerous other chemicals, thereby permitting Jefferson's entry into new fields based upon ethylene; Double the plant's capacity for ethylene glycol; and increase by 50 percent the production of ethylene oxide used in the manufacture of detergents and as a starting material for synthetic fibers.

The program will include installation of a direct oxidation unit to produce ethylene oxide. Jefferson also plans to continue operation of its existing chlorohydrination equipment and will produce ethylene oxide by both processes.

In addition, Jefferson will construct a plant to produce chlorine which will be used in the manufacture of ethylene oxide and ethylene dichloride. Much of the caustic soda resulting from the process will be marketed, while the hydrogen will be used by the Company.

Expansion plans also call for stepped-up output of a number of other chemicals, including specialty amines, such as morpholine, and ethylene oxide specialties.

The new facilities mark Jefferson's entry into the production of propylene oxide, propylene glycol and other propylene derivatives.

Jefferson Chemical Company is equally owned by American Cyanamid Company and The Texas Company.

Stipend for TRI Fellows Raised

Textile Research Institute recently announced that the stipend for first- and second-year Textile Research Institute Fellows at Princeton University would be raised from $1200 to $1500 per year in keeping with increased costs of living. The $1800 stipend for third-year fellows will remain unchanged. All fellowships include tuition and fees in addition to the stipend, and are granted on a twelve-month basis.

General Calendar

AMERICAN OIL CHEMISTS SOCIETY

Spring, 1957 (Spring meeting, New Orleans); Sept 30-Oct 2, 1957 (Fall meeting, Cincinnati); Apr 21-23, 1958 (Memphis); Oct 20-22, 1958 (Chicago); Spring, 1959 (New Orleans); Fall, 1959 (Los Angeles).

AMERICAN SOCIETY FOR QUALITY CONTROL

Feb 25-27—7th Annual Conference of the Textile Division, Georgia Tech, Atlanta, Ga.

THE DRYSALTERS CLUB OF NEW ENGLAND

Jan 21 (Hotel Somerset, Boston); Apr 26 (Hotel Vendome, Boston); June 21 (Annual Outing—Wachusett Country Club, West Boylston, Mass).

THE FIBER SOCIETY

Spring Meeting—May 1-2, 1957, The Clemson House, Clemson S C; Sept 4-6 (Joint meeting with the Textile Institute—Hotel Statler, Boston, Mass)

NATIONAL COTTON COUNCIL OF AMERICA

Feb 28-Mar 1 (Cotton Research Clinic, General Oglethorpe Hotel, Savannah, Ga). October 2-3 (Chemical Finishing Conference —Statler Hotel, Washington, DC)

PHI PSI FRATERNITY

April 25-27—Annual meeting, New Bedford Hotel, New Bedford, Mass.

TEXTILE QUALITY CONTROL ASSOCIATION

March 28-29 (Spring Meeting, Clemson House, Clemson, SC)

• NAMES IN THE NEWS •

SINGER

GLUCK

PRIME

HILL

EUDY

WEEKS

Emkay Chemical Company, Elizabeth, NJ, has announced the appointment of **Robert E Singer** to its technical sales staff to work with **Thomas J McDonald** in the New England area.

Mr Singer, who makes his home in Cranston, RI, has been representative for General Chemical Division of Allied Chemical & Dye Corporation for the past four years. Prior to that connection, he was with Scott Testers servicing textile, paper and leather plants.

Michael J Gluck has been appointed manager of overseas operations for Nuodex Products Company, a division of Heyden Chemical Corporation.

For the past four years Mr Gluck has been associated with Mallinckrodt Chemical Works export department as sales representative, and travelled extensively in Mexico, Central America and Cuba. Previously, he was with the export department of National Aniline Division of Allied Chemical & Dye Corporation for six years, three of which were spent in the European branch office.

Cornelius E Elphick, in charge of the warp sizing laboratory of the Nopco Chemical Company, retired September 21st after 20 years of service with Nopco.

Mr Elphick prepared for a textile career with study and plant experience in Switzerland, Germany and Italy, after which he worked for several major textile finishers.

Though he is now on the retired list, Mr Elphick will be retained by Nopco on a consulting basis.

Charles E Hoffman, a native of Atlanta, will represent Swift & Company's Industrial Oil Department in the Atlanta area.

Mr Hoffman joined Swift & Company in 1950 and has represented the Company at Atlanta and from Swift's General Offices at Chicago.

George E Prime has joined Stein Hall & Co, Inc, at its Southern Textile Laboratory, Charlotte, NC. In his new position he will assist the chief chemist in technical service and development work on new products for the textile field.

Mr Prime most recently served with the Esmond Chemical Company Division of General Products Company, where he was chief chemist of both the control and development laboratories and was also concerned with sales, service and plant production supervision.

Closely following the first anniversary of its marketing department, Shawinigan Resins Corporation recently announced the establishment of a Southern District Sales Office to be located in Atlanta, Ga.

Activities of the office, which is located at 1401 Peachtree Street, NE, will be directed by **W F Hill,** who is the newly appointed assistant district manager.

Mr Hill, who recently joined Shawinigan, formerly was a sales representative with Monsanto Chemical Company's Plastics Division in the Southern district.

The Twelfth Midwest Award for "meritorious contributions to the advancement of . . . chemistry or chemical education" was presented Nov 5 to **Carroll A Hochwalt** of the Monsanto Chemical Company. The prize, a gold medallion, is given annually by the American Chemical Society's St Louis Section.

Dr Hochwalt, who is vice-president for research, development and engineering, discussed "Fashions in Fibers" in his acceptance speech at the Coronado Hotel. **Hal G Johnson** of the Monsanto Chemical Company, chairman of the St Louis Section, made the presentation and **Roy E Dial,** research chemist of the Aluminum Company of America, St Louis, was toastmaster.

Stepan Chemical Company has announced that **George Eudy** is joining the organization as Southeastern sales representative. Mr Eudy was formerly associated with Onyx Oil and Chemical Company. Prior to that he had been associated with F H Ross and Company and Kerr Bleachery.

Kenneth L Weeks, Jr, has been appointed superintendent of Olin Mathieson Chemical Corporation operations at Brunswick, Ga.

Now under construction, the Brunswick facilities are expected to be ready to provide chlorine and caustic soda for the South Atlantic states shortly after the first of the year.

Mr Weeks joined Olin Mathieson in 1952 as a foreman at its McIntosh, Ala, plant and was made purchasing agent at that location a year ago.

Three new appointments to Food Machinery and Chemical Corporation's newly opened chemical research center at Princeton, NJ, have been announced.

Borivoj R S Franko-Filipastic has been named process section supervisor in the organic chemistry department. Before joining FMC, Dr Franko-Filipastic was with the research department of Olin Mathieson Chemical Corporation and with the Pittsburgh Plate Glass Research Laboratory.

Harold K Latourette has become exploratory section supervisor in the organic chemistry department. Dr Latourette was previously director of exploratory research of FMC's Westvaco Chlor-Alkali Division.

Charles F Ferraro has been appointed a research chemist for polymer application research in the plastics and polymers departments, where he will be in charge of the physical testing laboratories. For the past seven years he has been an assistant professor at Fordham University where he has conducted research on physico-chemical studies of polymers.

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